DOCUMENT RESUME

ED 063 469 VT 015 354

TITLE	Occupational Outlook Handbook. 1972-73 Edition.
INSTITUTION	Bureau of Labor Statistics (DOL), Washington, D.C.
REPORT NO	BLS-Bull-1700
PUB DATE	72
NOTE	885p.
AVAILABLE FROM	Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (L23:1700, $6.25)
EDRS PRICE	MF-$0.65 HC-$29.61
DESCRIPTORS	*Employment Opportunities; *Employment Qualifications; Employment Trends; Income; Manpower Needs; *Manuals; Occupational Guidance; *Occupational Information; *Vocational Counseling; Work Environment

ABSTRACT

Designed as a basic reference source for vocational counselors and manpower planners, this handbook includes job descriptions and employment outlook information for white-collar, blue-collar, and service occupations. Updated to include 26 new occupational and industry outlook statements, information in the handbook is based on data received from industry officials, labor organizations, trade associations, professional societies, government agencies, and other organizations. Specific information included for each occupational group deals with the nature of work involved, places of employment, qualifications, employment outlook, earnings, and working conditions. Sources of additional information are also suggested. (JS)

ED 063469

Occupational Outlook Handbook

1972-73 Edition

U.S. Department of Labor
Bureau of Labor Statistics
Bulletin 1700

Pointers on Using the Handbook

To learn the contents and arrangement of this Handbook see How the Handbook is Organized, page 5;

To locate an occupation or industry in this book, see:
Table of Contents, page ix.
Alphabetical Index, page 853.

For a general view of work and jobs in the United States, read the chapter on Tomorrow's Jobs, page 13.

Forecasts of the future are precarious! To interpret the standards on the outlook in each occupation, keep in mind the points made on page 13, as well as the methodology presented in the Technical Appendix. page 851.

The job picture is constantly changing. To find out how you can keep your information up to date, see the chapter on Sources of Additional Information or Assistance, page 9.

You may need local information too. The Handbook gives facts about each occupation for the United States as a whole. For suggestions on sources of additional information for your own locality, see page 10.

Subscribe To The Occupational Outlook Quarterly, An Essential Companion To Your Handbook

***it keeps up to date the volatile field of manpower and occupational information**

***it reports promptly on new occupational research results**

***it analyzes legislative, educational, and training developments that will help young people with their career plans**

Order form on back cover of this handbook

Occupational Outlook Handbook 1972-73 Edition

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY

U.S. Department of Labor
J. D. Hodgson, Secretary

Bureau of Labor Statistics
Geoffrey H. Moore, Commissioner

Bulletin 1700

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402 - Price $6.25

Foreword

In both human and economic terms, employment can be one of life's most rewarding experiences. A good job offers the pride of human achievement, an opportunity for individual growth, and a sense of personal usefulness. It also provides the welcome security of an adequate income.

But satisfying employment seldom is achieved without wise and informed career planning. Individuals must examine their own interests, abilities, and goals, and must know which occupations are best suited to these traits. Future workers also must know which skills will be needed in tomorrow's working world; skills that are obsolete or in oversupply are no passport to rewarding careers.

We at the Department of Labor believe that the *Occupational Outlook Handbook* contains information necessary to intelligent career planning. This edition provides information for more than 800 occupations so that young persons, veterans, women returning to the labor force, and others choosing careers can determine which jobs are best suited to their individual needs. The *Handbook* discusses the nature of work in different occupations, as well as earnings, job prospects during the 1970's, and education and training requirements. This information can help tomorrow's workers prepare for jobs that have a good future in our changing society.

Knowing that the men and women who enter the work force during the 1970's will be the best educated and most highly skilled workers in our history, the Department of Labor dedicates this *Occupational Outlook Handbook* to the hope that they also will be the most satisfied.

J. D. HODGSON, *Secretary of Labor*

Prefatory Note

The *Occupational Outlook Handbook* is the major publication resulting from the Bureau of Labor Statistics continuing program of research in occupational and manpower trends. Published every other year, the *Handbook* contains job descriptions and employment outlook information for white-collar, blue-collar, and service occupations. The publication is designed as a basic reference source for vocational counselors and manpower planners, as well as for individuals seeking career information.

The 1972–73 edition of the *Handbook* updates previously published occupational information and also presents 26 new occupational and industry outlook statements. Many of the additions reflect the growing demand for health and service workers. New statements describe, for example, biomedical engineering as well as promising subprofessional health occupations, such as electrocardiograph technician, occupational therapy aide, surgical technician, and optometric assistant. In addition, other new statements describe the work of parking lot attendants, guards and watchmen, city managers, social welfare aides, and insurance specialists.

Information in the *Handbook,* both updated and new, is based on BLS analyses of information received from industry officials, labor organizations, trade associations, professional societies, government agencies, and other organizations. The assistance of these individuals and groups is sincerely appreciated.

The Bureau of Labor Statistics is proud to serve those who seek vocational information through its occupational outlook program. Other outlook program publications include reprints of individual *Handbook* statements and the *Occupational Outlook Quarterly,* a magazine which reports occupational developments and research occurring between *Handbook* editions.

GEOFFREY H. MOORE, *Commissioner*
Bureau of Labor Statistics

Letter From the American Personnel and Guidance Association

As our Nation continues its economic growth and technological advancement, new jobs are created and others become obsolete. Keeping abreast of these changes and informed regarding vocational opportunities is an ongoing responsibility for the counselor. To be effective in the career exploration and decision-making process, counselors and clients must have, as one important resource, relevant information about current and projected job descriptions and employment practices.

The Bureau of Labor Statistics is to be commended for the effective utilization of its research facilities to provide the timely, readable, and useful information contained in the *Occupational Outlook Handbook* and its companion publication the *Occupational Outlook Quarterly.*

DONNA R. CHILES, *President*
American Personnel and Guidance Association

Letter From the Veterans Administration

A quarter of a century has passed since publication of the first edition of the *Occupational Outlook Handbook.* Developed initially as an outgrowth of a project to meet the needs of the Veterans Administration for sound occupational information in counseling World War II veterans seeking to return to school and work, the *Handbook* over the years, in a variety of settings, has deservedly achieved wide usage by counselors, educators, and young people generally.

Within the Veterans Administration, the *Handbook* continues to serve as a major resource in counseling an expanded population that now includes, in addition to disabled and nondisabled veterans, the wives and children of deceased or totally and permanently disabled veterans and, most recently, the wives and children of servicemen missing in action or forcibly detained by a foreign country. Disparate as these groups are in many respects, they all share the need for accurate current information about occupations in order to be able to make sound educational and vocational choices and plans. The *Occupational Outlook Handbook* provides such information on a scope unequalled by any other single source.

The Veterans Administration appreciates the unique contribution made by the *Handbook* in the past, and looks forward to its continued usefulness in the 1972–73 and future editions.

Sincerely,
DONALD E. JOHNSON, *Administrator*
Veterans Administration

Letter From the United States Training and Employment Service

In fiscal year 1970, approximately 10 million individuals sought jobs through local employment service offices, and more than one million of them received employment counseling. Many of these needed assistance in making a career choice—which is one of life's most challenging problems—as well as referrals to suitable jobs or training. The need for job information runs the gamut from youth seeking work for the first time to senior citizens who have been displaced from their jobs.

The effectiveness of vocational counseling depends not only on the competency and skill of the counselor and the reliability of his assessment tools, but upon having readily at hand a dependable source of occupational information about many kinds of careers. This information is also a vital element in promoting the most effective use of the manpower work and training programs that are available to thousands of disadvantaged persons. The United States Training and Employment Service and affiliated State agencies welcome this new edition of the *Occupational Outlook Handbook,* which has long been a classic in the field of guidance literature.

ROBERT J. BROWN, *Associate Manpower Administrator for*
U.S. Training and Employment Service
U.S. Department of Labor

Letter From the Social and Rehabilitation Service

In the coming year, more than 280,000 disabled men and women will be returned to productive activity through the State-Federal vocational rehabilitation program. Dignity and self-support through work has been a basic principle of the rehabilitation process since the public program began more than 50 years ago.

This new edition of the *Occupational Outlook Handbook* will continue to be an invaluable resource to counselors who are responsible for guiding clients to suitable opportunities in the nation's job market.

JOHN D. TWINAME, *Administrator*
Social and Rehabilitation Service
U.S. Department of Health, Education, and Welfare

Letter From the United States Office of Education

An underlying goal of education in our democratic society is to provide an opportunity for the maximum realization of individual potential. Because of the prevailing emphasis upon the general curriculum, a significant segment of the student population is now limited to this offering. We must build a new leadership and a new commitment to the concept of a career education system. The career development emphasis in education holds promise for meaningful educational experiences in terms of individual needs.

Realistic planning for career development calls for keeping abreast of the rapidly changing occupational structure in this complex, technological society. The *Occupational Outlook Handbook* fulfills this function by providing current, systematically organized information about occupational trends, requirements and opportunities. It is an invaluable resource for students, and those who assist them in the career development process, as they seek to develop their talents and achieve personal fulfillment as human beings.

To the Bureau of Labor Statistics, and particularly the *Handbook* staff, I would like to extend the congratulations and the thanks of the Office of Education.

Sincerely,
S. P. MARLAND, Jr.
U.S. Commissioner of Education

Letter From the Department of Defense

Armed Forces education officers and counselors have been using the *Occupational Outlook Handbook* for many years. It is a primary source of occupational information used to guide members of the Armed Forces to the opportunities off-duty educational programs offer for advancement in their military careers or in preparation for their return to civilian life.

Servicemen may participate in many off-duty educational programs throughout their military service; they are encouraged to pursue educational goals that will help their military careers and prepare them for future civilian careers. The *Occupational Outlook Handbook* has added significantly to Armed Forces educational programs as a source of career information for both professional and citizen servicemen.

On the basis of our experience with this valuable career guide, we commend it to all concerned with career planning.

GEORGE BENSON, *Deputy Assistant*
Secretary of Defense for Education

Contributors

The *Handbook* was prepared in the Bureau of Labor Statistics, Division of Manpower and Occupational Outlook, under the supervision of Russell B. Flanders. General direction was provided by Harold Goldstein, Assistant Commissioner for Manpower and Employment Statistics.

The planning and coordination of the *Handbook* was done by Neal H. Rosenthal, with the assistance of Gerard C. Smith. Michael F. Crowley directed the research program on white-collar and service occupations. Max L. Carey directed the research program on blue-collar occupations and on major industries and their occupations. The research and preparation of individual sections were supervised by William F. Hahn, Michael J. Pilot, and Joseph J. Rooney.

Members of the Division's staff who contributed sections were: Elinor Abramson, Marlene Ausmus, Louann Berman, Harold Blitz, Donald Clark, Norman I. Coakley, Jr., Constance B. DiCesare, Conley H. Dillon, Don Dillon, Susan C. Gentz, Kevin Kasunic, Joyce C. Kling, Annie Lefkowitz, Thomas M. McDonald, Maurice P. Moylan, Ludmilla K. Murphy, Kathleen A. Naughton, H. James Neary, Irving P. Phillips, John O. Plater, Jr., Joan Slowitsky, and Dixie Sommers.

Statistical assistance was provided by Sara G. Brown, Olive B. Clay, Jane K. Green, and Richard Frasch, under the direction of Jean F. Whetzel. Everett J. McDermott assisted in gathering and editing photographs.

The chapter on Agriculture was coordinated in the Office of Information, U.S. Department of Agriculture, under the direction of Harold R. Lewis, Director of Information.

Photograph Credits

The Bureau of Labor Statistics gratefully acknowledges the cooperation and assistance of the many government and private sources that either contributed photographs or made their facilities available to the U.S. Department of Labor photographers for this edition of the *Occupational Outlook Handbook*.

Government Sources

Federal. Department of Agriculture; Department of the Army—Walter Reed Army Medical Center; Atomic Energy Commission; Department of Commerce—National Oceanic and Atmospheric Administration, Maritime Administration, and National Bureau of Standards; Federal Power Commission; General Services Administration; Government Printing Office; Department of Health, Education, and Welfare—Health Services and Mental Health Administration, National Institutes of Health, and Vocational Rehabilitation Administration; Department of the Interior; Department of Justice—Federal Bureau of Investigation; Department of Labor—Training and Employment Service; National Aeronautics and Space Administration; Department of the Navy—Naval Photographic Center, and Naval Research Laboratory; Department of Transportation—Federal Aviation Agency; and Veterans' Administration.

State and Local. City of Chicago—Police Department; District of Columbia—Fire Department, Department of Sanitation, and Social Services Administration; and Commonwealth of Virginia—State Police.

Private Sources

Individuals. Burton Berinsky; Andrew Columbus; Jerome Footer, D.D.S.; and Alfred Statler.

Membership Groups. American Forest Products Industries, Inc.; American Home Economics Association; American Institute of Planners; American Optometric Association; American Paper Institute; American Podiatry Association; American Trucking Association; The College Placement Council, Inc.; International Alliance of Theatrical Stage Employers and Moving Picture Machine Operators of the United States and Canada; International Brotherhood of Electrical Workers; International Chiropractor Association; National Association of Home Builders; National Association of Metal Finishers; National Institute of Drycleaning; National Marine Engineer Beneficial Association; National Maritime Union of America; National Terrazzo and Mosaic Association; Pattern Makers League; Southeast Woman's Club of Washington, D.C.

Industry and Business. Acacia Mutual Life Insurance Co.; Aetna Shirt Co.; Allstate Insurance Co.; Aluminum Company of America; American Airlines, Inc.; American Machine and Foundry Co.; American Optical Co.; American Telephone and Telegraph Co.; Armstrong Cork Co.; Atchison, Topeka, and Santa Fe Railroad; Ball-Shea Norair; D. Ballauf and Co.; Banning Plymouth, Inc.; Bell Telephone Co.; Bethlehem Steel Corp.; Blake Construction Co.; Boeing Co.; Burroughs Corp.; Caterpillar Tractor Co.; Chrysler Corp.; Cities Service Oil Co.; Cleaver-Brooks; Collins Radio Co.; Danko Arlington, Inc.; D. C. Transit Co.; Don Reedy Appliance Service; E.I. DuPont de Nemours and Co.; Eastman Kodak Co.; Eastern Airlines; Erie Railroad; General Motors Corp.; Goodwill Industries; Great Northern Railway; Herson Auto and Appliance Co.; Hilton Hotels; Hughes Aircraft Co.; International Business Machines Corp.; I. C. Isaacs; Kaiser Engineers; Kimberly-Clark Corp.; Koons Ford, Inc.; Eli Lilly and Co.; Lockheed-Georgia Co.; Lustine Chevrolet; McLachlen Banking Corp.; Merkle Press, Inc.; Moore-McCormick Lines; Jack Morton Productions, Inc.; National Broadcasting Co.; New York, New Haven, and Hartford Railroad; North American Rockwell Corp.; North Indiana Public Service Co.; Oxford Paper Co.; Pan American Petroleum Corp.;

Pan American World Airways, Inc.; Potomac Electric Power Co.; Ransdell, Inc.; Reynolds Metals Co.; Royce's TV; Southern Pacific Co.; Standard Oil Company of New Jersey; Sterling Optical Co.; Swift and Co.; Tolman Laundry; Union Carbide Corp.; Union Pacific Railroad; United Air Lines; The Upjohn Co.; Westinghouse Corp.; and Woodward and Lothrop.

Publications. Clissold Publishing Co.; *Implement and Tractor* Magazine; *The Machinist Weekly; Signs of the Times* Magazine; and *The Washington Star.*

Schools. The Models Guild, Inc.

Others. Los Alamos Scientific Laboratory; National Symphony; Oakridge National Laboratory; and Washington Hospital Center.

Note

A great many trade associations, professional societies, unions, and industrial organizations are in a position to supply valuable information to counselors or young people seeking information about careers. For the convenience of *Handbook* users, the statements on separate occupations or industries list some of the organizations or other sources which may be able to provide further information. Although these references were assembled with care, the Bureau of Labor Statistics has no authority or facilities for investigating organizations. Also, since the Bureau has no way of knowing in advance what information or publications each organization may send in answer to a request, the Bureau cannot evaluate the accuracy of such information. *The listing of an organization, therefore, does not in any way constitute an endorsement or recommendation by the Bureau or the U.S. Department of Labor, either of the organization and its activities or of the information it may supply.* Such information as each organization may issue is, of course, sent out on its own responsibility.

The occupational statements in this Handbook are not intended, and should not be used, as standards for the determination of wages, hours, jurisdictional matters, appropriate bargaining units, or formal job evaluation systems. These descriptive statements are presented in a general, composite form and, therefore, cannot be expected to apply exactly to specific jobs in a particular industry, establishment, or locality.

Contents

Page

Guide to the Handbook

USING THE HANDBOOK IN GUIDANCE SERVICES 3
HOW THE HANDBOOK IS ORGANIZED 5
  Some important facts about the occupational reports 6
SOURCES OF ADDITIONAL INFORMATION OR ASSISTANCE 9
  Occupational outlook service publications and materials 9
  Services to jobseekers at public employment offices 10
TOMORROW'S JOBS 13

The Outlook for Occupations

PROFESSIONAL AND RELATED OCCUPATIONS 25
  Business administration and related professions 29
    Accountants 29
    Advertising workers 32
    Marketing research workers 34
    Personnel workers 37
    Public relations workers 39
  Clergymen 42
    Protestant ministers 42
    Rabbis 44
    Roman Catholic priests 45
  Conservation occupations 48
    Foresters 48
    Forestry aids 50
    Range managers 52
  Counseling occupations 55
    Employment counselors 55
    Rehabilitation counselors 58
    School counselors 60
  Engineers 63
    Aerospace 67
    Agricultural 68
    Biomedical 69
    Ceramic 69
    Chemical 70

Page
    Civil 71
    Electrical 71
    Industrial 73
    Mechanical 73
    Metallurgical 74
    Mining 75
  Health service occupations 77
    Physicians 77
    Osteopathic physicians 80
    Dentists 82
    Dental hygienists 85
    Dental assistants 87
    Dental laboratory technicians 89
    Registered nurses 91
    Licensed practical nurses 94
    Medical assistants 95
    Surgical technicians 97
    EEG technicians 99
    EKG technicians 100
    Inhalation therapists 102
    Optometrists 104
    Optometric assistants 106
    Pharmacists 107
    Podiatrists 110
    Chiropractors 111
    Occupational therapists 113
    Occupational therapy assistants 115
    Physical therapists 116
    Physical therapy assistants 118
    Speech pathologists and audiologists 120
    Medical laboratory workers 122
    Radiologic technologists 126
    Medical record librarians 127
    Dietitians 129
    Hospital administrators 131
    Sanitarians 133
    Veterinarians 136
  Mathematics and related fields 139
    Mathematicians 139
    Statisticians 142
    Actuaries 144
  Natural science occupations 147
    Environmental scientists 147
    Geologists 147
    Geophysicists 151
    Meteorologists 154
    Oceanographers 157

Page
Life science occupations 161
- Life scientists 161
- Biochemists 166

Physical scientists 169
- Chemists 169
- Physicists 173
- Astronomers 175
- Food scientists 178

Performing artists and other art related occupations 181
- Actors and actresses 181
- Dancers 184
- Musicians and music teachers 186
- Singers and singing teachers 189
- Commercial artists 192
- Industrial designers 194
- Interior designers and decorators 196

Social scientists 199
- Anthropologists 199
- Economists 201
- Geographers 203
- Historians 206
- Political scientists 207
- Sociologists 209

Teaching 211
- Kindergarten and elementary school teachers 211
- Secondary school teachers 214
- College and university teachers 216

Technician occupations 220
- Engineering and science technicians 220
- Draftsmen 226
- Food processing technicians 228

Writing occupations 231
- Newspaper reporters 231
- Technicial writers 233

Other professional and related occupations 237
- College career planning and placement counselors 239
- Home economists 241
- Landscape architects 244
- Lawyers 246
- Librarians 248
- Library technicians 253
- Photographers 254
- Systems analysts 257
- Programers 259

Page
- Psychologists 261
- Recreation workers 264
- Social workers 266
- Surveyors 269
- Urban planners 272

MANAGERIAL OCCUPATIONS 275
- City managers 277
- Industrial traffic managers 279
- Purchasing agents 281

CLERICAL AND RELATED OCCUPATIONS 283
- Bookkeeping workers 285
- Cashiers 286
- Electronic computer operating personnel 288
- File clerks 291
- Office machine operators 292
- Receptionists 295
- Shipping and receiving clerks 296
- Stock clerks 298
- Stenographers and secretaries 299
- Typists 302
- Telephone operators 303

SALES OCCUPATIONS 307
- Automobile parts countermen 308
- Automobile salesmen 310
- Automobile service advisors 312
- Insurance agents and brokers 314
- Manufacturers' salesmen 317
- Real estate salesmen and brokers 319
- Retail trade salesworkers 321
- Securities salesmen 324
- Wholesale trade salesworkers 327

SERVICE OCCUPATIONS 331
- Barbers 332
- Cosmetologists 335
- Cooks and chefs 336
- Waiters and waitresses 339
- Bartenders 341
- Guards and watchmen 343
- FBI special agents 345
- Police officers 346
- State police officers 349
- Firefighters 352
- Hospital attendants 354

Page
Private household workers 356
Building custodians 358
Social service aids 360
Models 362

SKILLED AND OTHER MANUAL OCCUPATIONS 365
Skilled workers 365
Semiskilled workers 367
Unskilled workers 369
Foremen 370
Building trades occupations 372
Asbestos and insulating workers.. 377
Bricklayers 379
Carpenters 382
Cement masons (cement and concrete finishers) 385
Construction laborers and hod carriers 388
Electricians (construction) 390
Elevator constructors 393
Floor covering installers 394
Glaziers 397
Lathers 399
Marble setters, tile setters, and terrazzo workers 401
Operating engineers (construction machinery operators) 405
Painters and paperhangers....... 407
Plasterers 410
Plumbers and pipefitters 413
Roofers 416
Sheet-metal workers 419
Stonemasons 421
Structural-, ornamental-, and reinforcing-iron workers, riggers, and machine movers... 423
Driving occupations 427
Over-the-road truckdrivers 427
Local truckdrivers 431
Routemen 432
Intercity busdrivers 432
Local transit busdrivers 439
Taxi drivers 442
Forge shop occupations 445
Machining occupations 449
All-round machinists 449
Machine tool operators 454
Tool and die makers 456

Page
Instrument makers (mechanical). 458
Setup men (machine tools) 460
Mechanics and repairmen 462
Air-conditioning, refrigeration, and heating mechanics 463
Appliance servicemen 466
Automobile body repairmen 469
Automobile mechanics 471
Bowling-pin-machine mechanics.. 475
Business machine servicemen 477
Diesel mechanics 483
Electric sign servicemen 486
Farm equipment mechanics 489
Industrial machinery repairmen... 491
Instrument repairmen 492
Maintenance electricians 495
Millwrights 498
Motorcycle mechanics 499
Television and radio service technicians 502
Truck mechanics and bus mechanics 505
Vending machine mechanics 507
Watch repairmen 510
Printing (graphic arts) occupations ... 513
Composing room occupations ... 517
Photoengravers 521
Electrotypers and stereotypers ... 522
Printing pressmen and assistants.. 523
Lithographic occupations 525
Bookbinders and related workers. 527
Some other manual occupations...... 529
Assemblers 529
Automobile painters 530
Automobile trimmers and installation men (automobile upholsterers) 532
Blacksmiths 535
Boilermaking occupations 536
Dispensing opticians and optical mechanics 539
Electroplaters 542
Furniture upholsterers 544
Gasoline service station attendants 546
Inspectors (manufacturing) 548
Jewelers and jewelry repairmen.. 549
Meat cutters 552
Motion picture projectionists 554
Parking attendants 556

Page
Photographic laboratory occupations ... 558
Power truck operators ... 560
Production painters ... 562
Shoe repairmen ... 563
Stationary engineers ... 565
Stationary firemen ... 567
Waste water treatment plant operators ... 569
Welders and oxygen and arc cutters ... 571

Some Major Industries and Their Occupations

AGRICULTURE ... 579
- Opportunities on farms ... 580
- Opportunities on specific types of farms
- Occupations related to agriculture ... 582
  - Cooperative extension service workers ... 586
  - Soil scientists ... 587
  - Soil conservationists ... 588
  - Other professional workers ... 589
  - Farm service jobs ... 592

MINING ... 593
- Petroleum and natural gas production and processing occupations ... 593

CONSTRUCTION ... 601

MANUFACTURING ... 603
- Aircraft, missile, and spacecraft manufacturing ... 605
- Aluminum industry ... 614
- Apparel industry ... 621
- Atomic energy field ... 630
- Baking industry ... 640
- Drug industry ... 645
- Electronics manufacturing ... 651
- Foundries ... 660
  - Patternmakers ... 663
  - Molders ... 665
  - Coremakers ... 667
- Industrial chemical industry ... 669
- Iron and steel industry ... 674
- Motor vehicle and equipment manufacturing ... 685
- Office machine and computer manufacturing ... 694
- Paper and allied products industries ... 700
- Petroleum refining ... 707

TRANSPORTATION, COMMUNICATION, AND PUBLIC UTILITIES ... 711
- Civil aviation ... 713
  - Pilots and copilots ... 715
  - Flight engineers ... 718
  - Stewardesses ... 720
  - Aircraft mechanics ... 721
  - Airline dispatchers ... 724
  - Air traffic controllers ... 725
  - Ground radio operators and teletypists ... 727
  - Traffic agents and clerks ... 728
- Electric power industry ... 730
  - Powerplant occupations ... 733
  - Transmission and distribution occupations ... 736
  - Customer service occupations ... 739
- Merchant marine occupations ... 741
  - Licensed merchant marine officers. 743
  - Unlicensed merchant seamen ... 748
- Radio and television broadcasting ... 752
  - Radio and television announcers .. 758
  - Broadcast technicians ... 759
- Railroads ... 763
  - Locomotive engineers ... 767
  - Locomotive firemen (helpers) ... 768
  - Conductors ... 770
  - Brakemen ... 771
  - Telegraphers, telephoners, and towermen ... 772
  - Station agents ... 773
  - Clerks ... 774
  - Shop trades ... 775
  - Signal department workers ... 777
  - Track workers ... 778
  - Bridge and building workers ... 779
- Telephone industry ... 781
  - Telephone craftsmen ... 784
  - Central office craftsmen ... 784
  - Central office equipment installers. 786
  - Linemen and cable splicers ... 787
  - Telephone and PBX installers and repairmen ... 789
- Trucking industry ... 792

WHOLESALE AND RETAIL TRADE ... 797
- Restaurants ... 799

Page
FINANCE, INSURANCE, AND REAL ESTATE 803
 Banking 804
  Bank clerks 806
  Tellers 808
  Bank officers 810
 Insurance 812
  Claim adjusters 816
  Claim examiners 819
  Underwriters 821

SERVICE AND MISCELLANEOUS 825
 Hotel occupations 827
  Bellmen and bell captains 829
  Front office clerks 830
  Hotel housekeepers and assistants. 832
  Hotel managers and assistants.... 833
 Laundry and drycleaning plants 835

GOVERNMENT 839
 Federal civilian employment 841
  Post office occupations 846
 State and local governments 847
 Armed Forces 849

TECHNICAL APPENDIX 851

INDEX TO OCCUPATIONS AND INDUSTRIES 853

GUIDE TO THE HANDBOOK

USING THE HANDBOOK IN GUIDANCE SERVICES

The changing occupational structure and outlook within our increasingly complex technological society points up the urgency for greater emphasis upon career development and the vocational aspects of guidance. The career development concept may well become the focal point for a reorientation of the total educational effort towards the maximum development of each individual's potential. The process of career development stresses the importance of strengthening the program of informational services within a total program of guidance and counseling services. One of the most valuable resources for occupational and career information is the *Occupational Outlook Handbook*.

The Vocational Education Amendments of 1968 have reemphasized the need for education about the structure, nature, and trends of the entire spectrum of occupations as an essential and integral component of developmental career education. As a result, there is throughout the Nation a rapid increase in the number and variety of work and related education and training opportunities being developed, produced, and utilized. These multi-media approaches range from the printed word, through films and TV tapes, to computer-assisted methods. A great many of these resources depend upon the *Occupational Outlook Handbook* as a primary source of authoritative data.

It is being increasingly recognized that a developmental approach to career education and guidance requires sequential, articulated programming from the kindergarten through each successive "level" of education. In broad process terms, the progression is frequently described as moving primarily from early awareness, through orientation, to exploration, to more selective and intensive investigation and consideration as appropriate group and individual maturation and current needs. These broad processes, so described, relate both to the self and to the world of work, and to the interrelationships. In one form or another, then, the kinds of information provided by the *Occupational Outlook Handbook* increasingly become functional throughout the educational process.

It is basic to observe also that education for career development and guidance entails a total-school involvement. The teaching function as well as the counseling function takes on a greater commitment to this aspect of human development along with other aspects. The instructional curriculum as well as the specialized guidance and counseling services becomes crucially involved. As this total school approach evolves, occupational information from this *Handbook* and other sources will be more widely incorporated in academic as well pre-vocational and vocational courses of instruction, classroom activities, and teacher resource materials, in addition to being available in counseling offices and school libraries. A corollary of such developments as these is the need for buttressing the pre-service and in-service development of all kinds of educational personnel to plan and implement career education and guidance.

The *Handbook,* now in the eleventh edition, is designed both for individual and group use in a variety of settings. Settings include junior and senior high schools, vocational and technical schools, junior and community colleges, college student personnel centers, college preparation programs, private and public placement and counseling agencies, youth opportunity centers, and in-service education programs. A student, in pursuing his long-range career development goals—or those who assist him, such as counselors, teachers, parents—will find the *Handbook* to be a reliable, systematically organized reference, which provides a comprehensive overview of occupational requirements and opportunities. The organization of the *Handbook* is especially appropriate for use by persons working with groups. It analyzes job prospects in the world of tomorrow with well-designed and easily understood charts and graphs. The *Handbook*'s supplementary services consisting of reprints of individual occupations and charts illustrating occupational trends are helpful not only in counseling individuals, but also in working with groups of students and with parents as they become involved in assisting their children with occupational choices.

Counselors find the *Handbook* an invaluable tool in career planning and educational counseling. It provides an overview of the world of work in terms of major occupational categories which is useful at the elementary school level as well as in and beyond junior and senior high schools. The *Handbook* lends itself well to use by teachers in relating the significance of subject matter areas to occupational "families" and by counselors in applying the career ladder concept to career development. The frequency of revision assures that the occupational and career information pertaining to the rapidly changing occupational structure is current and relevant. The *Handbook* reveals how the nature of occupations and their respective employment opportunities are changing, and the importance of flexible planning in terms of major interest areas.

As a part of the total information services within the guidance program, the *Handbook* deserves a high priority as an indispensible resource for career development.

Don D. Twiford,
Senior Specialist
Guidance and Personnel Services
and
David H. Pritchard,
Senior Program Officer
Guidance, Counseling, and Placement
Office of Education,
U. S. Department of Health, Education, and Welfare

HOW THE HANDBOOK IS ORGANIZED

The *Handbook* starts with three introductory chapters designed to help counselors and students make effective use of the book and to give them a general view of the world of work.

This chapter describes the contents and organization of the book. It tells how the information was assembled and discusses a number of points which need to be kept in mind in interpreting the statements. The second introductory chapter gives suggestions regarding supplementary sources of occupational information and tells how readers can keep up to date on developments affecting the employment outlook in different occupations. It also describes briefly the counseling, placement, and other services available to jobseekers at local offices of State employment services affiliated with the U.S. Training and Employment Service in the Manpower Administration. The final introductory chapter describes some of the most important occupational and industrial employment trends to provide a background for interpreting the reports on individual occupations.

Occupational Reports

The reports on different fields of work make up the main body of the book. The seven major divisions of the book are: professional and related occupations; managerial occupations; clerical and related occupations; sales occupations; service occupations; skilled and other manual occupations; and some major industries and their occupations. Within each of these major divisions, occupations are grouped into related fields. The introductory statement for each major industry group provides information on occupational trends in the industry.

Indexes and Appendix

To help the readers locate information on the occupations in which they are interested, a detailed list of the occupational reports by field of work, is included in the table of contents at the front of the book. The index at the back of the book lists occupations and industries alphabetically. The occupations covered in the *Occupational Outlook Handbook* also are coded according to the occupational classification system developed by the U.S. Department of Labor and published in the *Dictionary of Occupational Titles*. This *Dictionary* provides a code number (the so-called D.O.T. number) for each occupation included in it; the code number can be used as a filing system for occupational information. The code numbers of the D.O.T. are listed in parentheses immediately below the main occupational group headings in the *Handbook*. Volumes I and II of the D.O.T. contain job classifications and definitions; a supplement lists individual physical demands, working conditions, and training time data for each job defined in the *Dictionary*.

The technical appendix of this *Handbook* discusses the sources and methods used to analyze the occupational outlook in different fields of work. It is designed for readers wishing more information on this subject than is included in this chapter.

Sources of Information

Information on employment trends and outlook and the many related topics discussed in the occupational reports was drawn from a great variety of sources. Interviews with hundreds of persons in industry, unions, trade associations, and public agencies provided a great deal of up-to-date information. The Bureau's other research programs supplied data on employment in different industries, productivity and technological developments, wages and working conditions, trade union agreements, industrial hazards, and a number of other topics. Additional data regarding the nature of the work in various occupations, training and licensing requirements, wages, and employment trends were provided by other agencies of the Federal Government—among them, the Bureau of Apprenticeship and Training and the U.S. Training and Employment Service, Manpower Administration, Department of Labor; the Bureau of the Census, Department of Commerce; the

Office of Education and the Vocational Rehabilitation Administration, Department of Health, Education, and Welfare; the Veterans Administration; the Civil Service Administration; the Interstate Commerce Commission; the Civil Aeronautics Board; the Federal Communications Commission; the Department of Transportation; and the National Science Foundation. Many other public and private organizations—including State licensing boards, educational institutions, business firms, professional societies, trade associations, and trade unions—also made available published and unpublished data and supplied much helpful information through interviews.

Some important facts about the occupational reports

Occupations Covered

The more than 800 occupations discussed in this *Handbook* generally are those of greatest interest to young people. Most of the major ones requiring long periods of education or training are discussed, as are a number of small but rapidly growing fields and other occupations of special interest. Altogether, the occupations covered account for about 97 percent of all workers in sales occupations; about 95 percent of all workers in professional and related occupations; about two-thirds of all workers in skilled, clerical, and service occupations, and two-fifths of those in semiskilled occupations. Smaller proportions of managerial workers and laborers are discussed. The main types of farming occupations also are discussed.

General information on many fields of work not covered in the occupational reports is contained in the introductions to the major divisions of the book. These introductions are designed to aid the reader in interpreting the reports on individual occupations.

After the information from these many sources was brought together and analyzed in conjunction with the Bureau's overall economic model, conclusions were reached as to prospective employment trends in the occupations. (See the Technical Appendix, page 851, for a discussion of the methodology used in employment outlook analysis.) In addition, estimates were made of the numbers of job openings that will be created by retirements and deaths and transfers out of the occupation. The supply of new workers likely to be available in particular fields also was analyzed, by studying statistics on high school and college enrollments and graduations, data on the number of apprentices in skilled trades, re-entries to an occupation, and transfers into an occupation.

Preliminary drafts of the occupational reports were reviewed by officials of leading companies, trade associations, trade unions, and professional societies, and by other experts. The information and conclusions presented in each report thus reflect the knowledge and judgment not only of the Bureau of Labor Statistics staff, but also of leaders in the field discussed, although the Bureau, of course, takes full reponsibility for all statements made. The technical appendix presents a more detailed discussion of the sources of information used in the occupational reports.

Points To Bear in Mind in Using the Reports

In using the information on employment prospects which this book contains, it is important to keep in mind that all conclusions about the economic future necessarily rest on certain assumptions. Among the assumptions which underlie the statements on employment outlook in this *Handbook*, are that high employment levels will be maintained and that no cataclysmic events will occur, such as a war or a severe and prolonged economic depression. Such catastrophes would, of course, create an entirely different employment situation from that likely to develop under the assumed conditions. But young people would find it impossible to build their lifetime plans in expectation of such unpredictable catastrophes, although, on the basis of historical experience, they must be prepared to weather economic ups and downs during their working lives. The basic economic assumptions are discussed in detail in the introductory section of the *Handbook,* Tomorrow's Jobs, page 13.

To avoid constant repetition, the assumptions seldom are mentioned in the reports on the many fields of work where the impact of a general decline in business or a change in the scale of mobilization would probably be about the same as in the economy as a whole. On the other hand, in the statements on occupations where employment tends to be either unusually stable or especially subject to ups and downs, the factors affecting employment are delineated. Even in the latter occupations, however, long-term trends in employment are more important than short-run fluctuations when appraising the prospects for an individual in a particular occupation.

The picture of employment opportunities given in this book applies to the country as a whole unless otherwise indicated. People who want supplementary information on job opportunities in their communities should consult local sources of information, as suggested in the next chapter.

The information presented on earnings and working conditions, as on other subjects, represents the most recent available when the *Handbook* was prepared early in 1971. Much of the information came from Bureau of Labor Statistics surveys, but many other sources were utilized also. For this reason, the earnings data presented in the various occupational reports often refer to different periods of time, cover varying geographic areas, and represent different kinds of statistical measures. Comparisons between the earnings data for different occupations should, therefore, be made with great caution.

Reference has been made in several occupational statements to training programs established under the Manpower Development and Training Act (MDTA), to equip unemployed and underemployed persons with skills needed in today's world of work. However, the absence of a reference to MDTA training for a particular occupation does not necessarily mean that programs are not in operation. In 1971, training programs (which last from several weeks to 2 years) covered several hundred occupations—technical and semiprofessional, skilled and semiskilled, clerical and sales, service and nonagricultural. To obtain information about MDTA training offered in your area, contact the local office of the State employment service.

Finally, information on occupations and the employment opportunities they offer is only part of that needed in making a career decision, which means matching a person and an occupation. The other part relates, of course, to the aptitudes and interests of the potential worker himself. In assessing their own abilities and interests and in selecting the occupation for which they are best suited, people can obtain help from vocational counselors in schools and colleges, State employment service offices, Veterans Administration regional offices and guidance centers, and many community agencies.

SOURCES OF ADDITIONAL INFORMATION OR ASSISTANCE

Persons using this *Handbook* may want more detail on the occupations discussed in the occupational reports, or information on fields of work which are not covered in this publication.

Suggestions as to sources of additional information on the occupations discussed are given in most of the occupational reports. In addition, several types of publications of the U.S. Department of Labor (see descriptions following index), provide further information on topics such as earnings, hours of work, and working conditions. Other sources likely to be helpful include public libraries; schools; State employment services; business establishments; and trade unions, employers' associations, and professional societies. A brief description of each follows.

Public Libraries

These libraries usually have many books, pamphlets, and magazine articles giving information about different occupations. They also may have several books and current indexes which list the great numbers of publications on occupations, and the librarians may be of assistance in finding the best ones on a particular field of work.

Schools

School libraries and guidance offices also often have extensive reading materials on occupations. In addition, school counselors and teachers usually know of any local occupational information which has been assembled through special surveys made by schools or other community agencies. Teachers of special subjects such as music, printing, and shorthand can often give information about occupations related to the subjects they teach.

State Employment Services

Counselors in local public employment offices are in a particularly good position to supply information about job opportunities, hiring standards, and wages in their localities. (The services available through the public employment offices are described in the concluding section of this chapter.)

Business Establishments

Employers and personnel officers usually can supply information about the nature of the work performed by employees in their industry or business and the qualifications needed for various jobs, as well as other facts about employment conditions and opportunities. The names of local firms in a particular industry can be found in the classified sections of telephone directories or can be obtained from local chambers of commerce.

Trade Unions, Employers' Associations, and Professional Societies

Frequently, these organizations have local branches; their officials can supply information relating to the occupations with which they are concerned.

Occupational outlook service publications and materials

In addition to this *Handbook*, the Bureau of Labor Statistics issues a periodical, the *Occupational Outlook Quarterly*, to keep readers up to date between editions of the *Handbook*, on developments affecting employment opportunities and on the findings of new occupational outlook research. In addition, the Bureau issues at irregular intervals occupational outlook bulletins which give much more detailed information on various fields of work than can be included either in the *Handbook* or in the *Occupational Outlook Quarterly*.

The Bureau also has developed a visual aid for counselors entitled *Jobs for the 70's*. It consists of a set of 40 color slides that show the changing occupational and industrial mix, and trends for manpower development, education, and training. The slides, which have an accompanying narrative, are available directly from the Bureau of Labor Statistics Regional Offices. (See order form in back of *Handbook*.)

The Bureau of Labor Statistics has published a *Counselor's Guide to Manpower Information, An Annotated Bibliography of Government Publications*. The bibliography, as the title suggests, lists major occupational and other manpower publications of Federal and State government agencies. These will be useful to counselors and others interested in trends and developments that have implications for career decisions. This bulletin, No. 1598, is available from the Superintendent of Documents, Government Printing Office, Washington, D.C., 20402, at $1 a copy.

The Bureau will be glad to place the name of any user of this *Handbook* on its mailing list to receive announcements of new publications and releases summarizing the results of new studies. Anyone wishing to receive such materials should send the request, with his address, to the Bureau of Labor Statistics, U.S. Department of Labor, Washington, D.C., 20212.

Services to jobseekers at public employment offices

Local offices of State employment services specialize in finding jobs for workers and workers for jobs. The State employment services are affiliated with the U.S. Training and Employment Service of the U.S. Department of Labor's Manpower Administration and constitute a Federal-State partnership. Employment and related services are available without charge in every State.

At each of the over 2,000 public employment service offices across the Nation, jobseekers are aided in obtaining employment, and employers are assisted in finding qualified workers.

Four basic services are provided to workers by the public employment service: (1) Job information; (2) employment counseling; (3) referral to job training; and (4) job placement.

Job Information. The personnel who staff the public employment service offices are familiar with their areas and thus know what kinds of workers are employed in local industry, what jobs are available, what the hiring requirements and the opportunities for advancement are, and the wages that are paid. The staff conduct manpower surveys to determine the area's available skills, training needs, and future occupational opportunities. Through the employment service network of offices, information is also available on job opportunities in other areas of the country.

Employment Counseling. Employment counseling assists young people who are starting their careers, as well as experienced workers who wish or need to change their occupation. The major purposes of employment counseling are to help people understand their actual and potential abilities, their interests, and their personal traits; to know the nature of occupations; and to make the best use of their capacities and preferences in the light of available job opportunities.

The employment counselor is specially trained and has access to a large store of occupational information.

Testing. Most local offices have available testing services which the counselor may use to assist him in appraising an individual's aptitudes, interests, and clerical and literacy skills.

USTES aptitude tests are particularly helpful in relating applicant's potential abilities to the aptitude requirements of 62 broad occupational groupings and hundreds of specific occupations. A nonreading edition has also been developed for individuals with very limited education.

Referral to Training. Many individuals seek work for which they lack some qualifications. Sometimes the job requires basic education or a specific skill. Besides referring a jobseeker to a job, the public employment service may suggest training so the applicant can qualify or secure a better job.

Jobs and job requirements change. In today's fast-paced world, important considerations when selecting a vocation are the training required to perform the work, and ways that training need can be met.

Job Placement. A primary objective of the public employment service is to place workers in jobs. Regular contact is maintained with local employers to learn about their job openings. Requests are received from employers for many different kinds of workers. As a result, registered applicants have access to a variety of job vacancies with many employers, just as the employer has access to many applicants. This dual function eliminates "hit-or-miss" job hunting.

If job openings are not available locally, applicants may apply for employment elsewhere in the State, in another area, or even in a foreign country. Each State employment service prepares inventories of its hard-to-fill jobs so that other State employment services may refer local workers to out-of-area jobs for which they qualify. In addition, a national network of highly specialized professional placement offices operates within the employment service network to speed the matching of jobs and applicants in professional fields.

Special Services for Youth. The Employment Service maintains a year-round program of services to youth, including counseling, job development, placement, training and referral to other agencies. In addition, there are two special efforts. (1) In the Summer Employment Program, the Employment Service enlists the cooperation of business, Government, and other groups to develop as many employment opportunities as possible for disadvantaged youth to provide valuable summer work experience and enable them to return to school in the fall. (2) The Cooperative School Program provides employment-related services to graduating seniors, school dropouts, and potential dropouts who desire to enter the labor market. Through this program they are provided employment counseling, testing, job development, referral to jobs or training, and followup services.

Special Services for Disadvantaged Adults. Through its human resources development program, the employment service seeks to improve the employability of adults who are not in the work force because of some social or cultural disadvantage. An important part of this program is "outreach" into slum areas.

Other Special Services. Individuals with mental or physical disabilities which constitute vocational handicaps are given special consideration by the employment service.

Veterans also receive special services. Each local office has a veterans' employment representative who is informed about veterans' rights and benefits, and seeks to develop jobs for veterans.

Middle-age and older workers are assisted in making realistic job choices and overcoming problems related to getting and holding jobs. Employers are encouraged to hire individuals on their ability to perform the work. Similar attention is given to the employment problems of minority group members and all others facing special difficulties in obtaining suitable employment.

Community Manpower Service. Jobseekers, employers, schools, civic groups, and public and private agencies concerned with manpower problems are invited to utilize the service of the public employment office in their community, and avail themselves of the job information in that office. The local office is listed in the phone book as an agency of the State government.

TOMORROW'S JOBS

Young people in an ever growing and changing society are faced with the difficult task of making sound career plans from among thousands of alternatives. As the economy continues to expand, this planning process becomes more difficult. Making career plans calls for an evaluation of an individual's interests and abilities, as well as specific information on occupations. This *Handbook* provides counselors, teachers, parents, and students with occupational information on training and education requirements, employment opportunities, and the nature of the work.

Several questions are of major importance to young persons as they view the variety of occupational choices open to them. Among these questions are: What fields look especially promising for employment opportunities? What competition will other workers furnish? What type and how much training and education are required to enter particular jobs? How do earnings in certain occupations compare with earnings in other occupations requiring similar training? What types of employers provide which kinds of jobs? What are the typical environment and working conditions associated with particular occupations?

Of importance in evaluating information that answers these and related questions is knowledge of the dynamic changes that are continually occurring in our economy —the trends in the Nation's work force and its business, industrial, and occupational development. New ways of making goods, new products, and changes in living standards are constantly changing the types of jobs that become available. To throw light on the changing characteristics of occupations and to provide background for understanding the outlook in specific occupations, this chapter focuses on overall patterns of change in the country's industrial and occupational composition. It also discusses the implications of these changes on education and training in relation to occupational choice.

No one can accurately forecast the future. Nevertheless, by using the wealth of information available, extensive economic and statistical analyses, and the best judgment of informed experts, the work future can be described in broad terms. Of course, some aspects of the future can be predicted more accurately than others. For example, the number of 18-year-olds in 1980 can be estimated with a very high degree of accuracy because individuals 8 years old in 1970 are accounted for in our vital statistics, and the death rate of children between 8 and 18 is extremely low and stays about the same from year to year. On the other hand, forecasting employment requirements for automobile assemblers in 1980 is extremely difficult. Employment of these workers can be affected by the changing demand for American-made automobiles, shifts in buyer's preference (toward the compact car, for example), changes in the ways cars are made (more automation or the use of turbine engines), and unpredictable economic developments outside of the automobile industry.

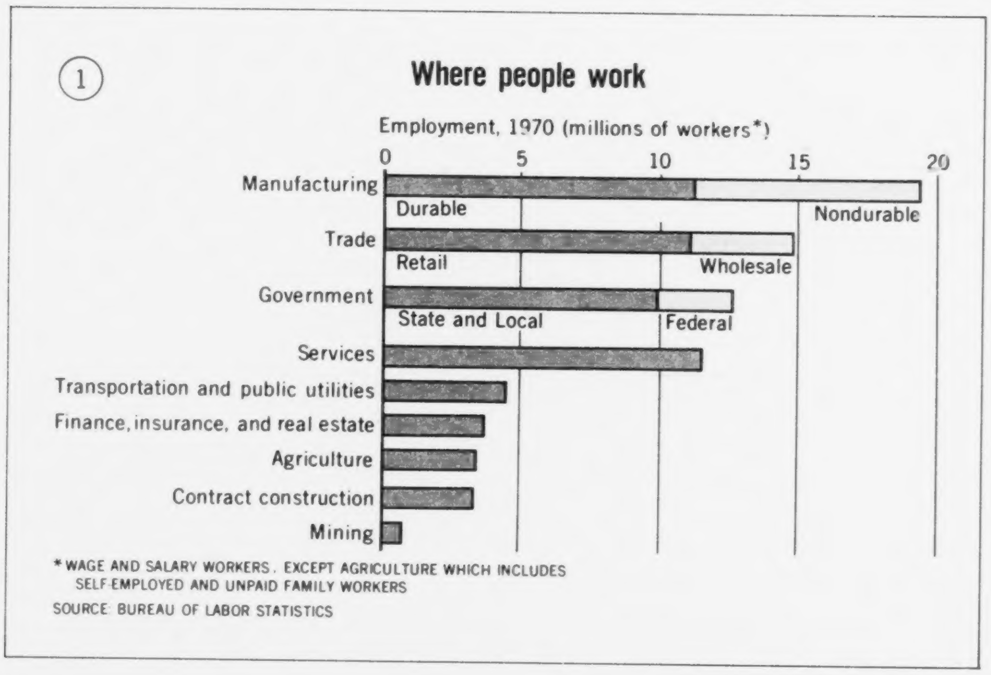
To project the demand for all workers in the economy, specific assumptions have to be made about general economic movements and broad national policy. The picture of the future employment outlook reflected in the *Handbook* is based on the following fundamental assumptions:

1. Maintenance of high levels of employment and of utilization of available manpower in 1980;
2. that no major event will alter substantially the rate and nature of economic growth;
3. that economic and social patterns and relationships will continue to change at about the same rate as in the recent past;
4. that scientific technological advancement will continue at about the same rate as in recent years; and
5. that the United States will no longer be fighting a war. On the other hand, a still guarded relationship between the major powers will permit no major reduction in armaments but defense expenditures can be reduced from the peak levels of the Vietnam conflict.

The *Handbook's* assessment of 1980 industrial and occupational outlook assumes a projected total labor force of 100.7 million in 1980, an Armed Forces of 2.7 million, and a resulting civilian labor force of 98 million.

Knowledge of specific industries is necessary because employers seek a wide variety of skills, for example, many different industries employ engineers, salesmen, and secretaries. Employment patterns have shifted considerably over the years and are expected to continue to do so. These changes greatly affect employment opportunities and occupational choices.

Industry employment and occupational requirements change as a result of many factors. A new machine or a newly automated proc-



Where people work

* WAGE AND SALARY WORKERS, EXCEPT AGRICULTURE WHICH INCLUDES SELF-EMPLOYED AND UNPAID FAMILY WORKERS
SOURCE: BUREAU OF LABOR STATISTICS

ess may require different occupational skills or may even create an entirely new occupation; a change in product demand may affect the number of workers needed; an invention may all but eliminate an industry or create a new one.

Industrial Profile

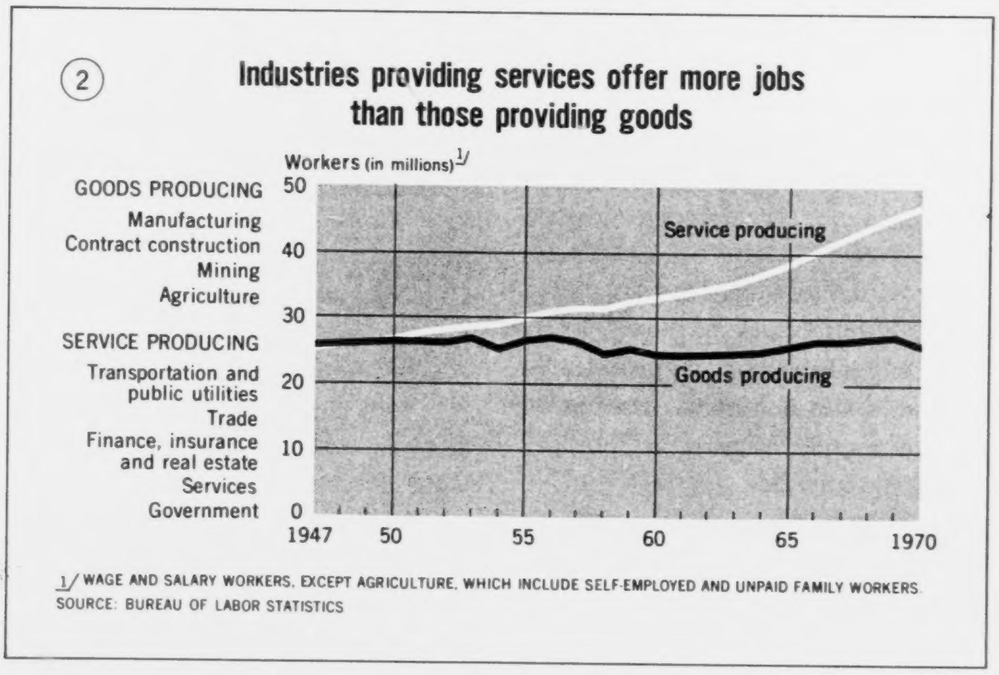
To help understand the Nation's industrial composition, industries may be viewed as either goods producing or service producing. They may further be grouped into nine major divisions according to this product or service. (See chart 1.)

Most of the Nation's workers are in industries producing services, in activities such as education, health care, trade, repair and maintenance, and in government, transportation, and banking and insurance service. The production of goods—raising food crops, building, extracting minerals, and manufacturing of goods—has required less than half of the country's work force since the late 1940's. (See chart 2.) In general, job growth through the 1970's is expected to continue to be faster in the service-producing industries than in the goods-producing industries. However, among industry divisions within both the goods-producing and service-producing sectors, the growth pattern will continue to vary. (See chart 3.)

Service-producing industries. In 1970, about 47.3 million workers were on the payrolls of service-producing industries—trade; Government; services and miscellaneous; transportation and other utilities; and finance, insurance, and real estate—about 13.5 million greater than the number employed in 1960. The major factors underlying this rapid post World War II growth have been (1) population growth; (2) increasing urbanization, with its accompanying need for more city service; and (3) rising income and living standards accompanying demand for improved services, such as health, education, and security. These factors are expected to continue to result in rapid growth of service industries as a group, and to employ 59.5 million by 1980, an increase of about 26 percent above the 1970 level.

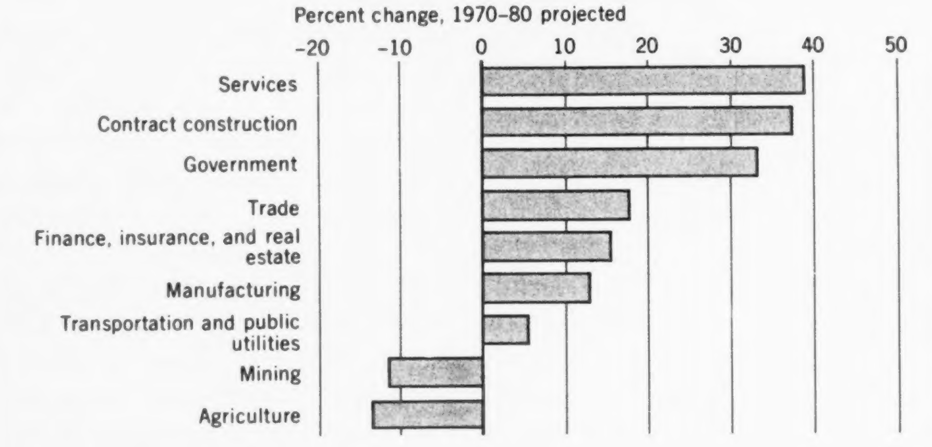
Trade, the largest division within the service-producing industries, has expanded sharply since 1960. Wholesale and retail outlets have multiplied in large and small cities to satisfy the need of an increasingly urban society. Employment in trade was about 14.9 million in 1970, about 31 percent above the 1960 level.

Employment in trade is expected to grow by about 18 percent between 1970 and 1980. Although an



Industries providing services offer more jobs than those providing goods

1/ WAGE AND SALARY WORKERS, EXCEPT AGRICULTURE, WHICH INCLUDE SELF-EMPLOYED AND UNPAID FAMILY WORKERS.
SOURCE: BUREAU OF LABOR STATISTICS



③ **Through the 1970's, employment growth will vary widely by industry**

SOURCE: BUREAU OF LABOR STATISTICS

ever-increasing volume of merchandise will be distributed as a result of increases in population and consumer expenditures, the rate of increase in manpower needs will be slowed by laborsaving technology such as the greater use of electronic data processing equipment and automated warehousing equipment, growth in the number of self-service stores, and the growing use of vending machines.

Government employment has grown faster than any other industry division, and has increased by more than one-half from 8.4 million to 12.6 million between 1960 and 1970. Growth has been mostly at the State and local levels, which combined increased by almost two-thirds. Employment growth has been greatest in agencies providing education, health, sanitation, welfare, and protective services. Federal Government employment increased about 19 percent between 1960 and 1970.

Government will continue to be a major source of new jobs through the 1970's. By 1980, employment in Government may be as much as 33 percent higher than in 1970. Most of the growth will be in State and local governments in which employment needs may rise by 1980, to 13.8 million about 40 percent higher than the 9.9 million employed in 1970. Federal Government employment is expected to rise slowly to about 3 million to 1980, 300,000 or about 11 percent above the 1970 level of 2.7 million.

Services and miscellaneous industries employment has increased rapidly since World War II as a result of the growing need for maintenance and repair, advertising, domestic, and health care services. From 1960 to 1970, total employment in this industry division rose by about two-fifths from slightly more than 8.0 million to about 11.6 million.

Service and miscellaneous industries will continue to be among the fastest growing industries through the 1970's. About two-fifths again as many workers are expected to be employed in this industry division in 1980 as in 1970. Manpower requirements in health services are expected to grow rapidly due to population growth and the increasing ability of persons to pay for health care. Business services including accounting, data processing, and maintenance also are expected to grow very rapidly.

Transportation and public utility employment in 1970 at 4.5 million was only slightly more than one-tenth higher than in 1960. Different parts of this industry, however, have experienced different growth trends. For example, air travel employment increased rapidly but the railroad industry declined.

The number of jobs in transportation and public utilities as a whole is expected to continue to increase slowly through the 1970's and widely differing employment trends will continue to be experienced among individual industries within the division. Rapid increases in employment are expected in air transportation and a decline is expected to continue in railroad employment and little or no change is expected in water transportation, and electric, gas, and sanitary services. Overall employment in this industry division is expected to increase to more than 4.7 million in 1980, 5 percent above the 1970 level.

Finance, insurance, and real estate, the smallest of the service-producing industry divisions, has grown about 38 percent since 1960, from nearly 2.7 million in 1960 to nearly 3.7 million in 1970. Employment has grown especially rapidly in banks; credit agencies; and security and commodity brokers, dealers, exchanges, and services.

Job growth in finance, insurance, and real estate will keep in step with the overall employment increases of nonfarm employment through the 1970's. Finance, insurance, and real estate employment is expected to expand to nearly 4.3 million by 1980, about 16 percent above 1970 levels. The most rapid advances will be in banking and credit agencies, which combined account for nearly two-fifths of total employment in this industry division.

Goods-Producing Industries. Employment in the goods-producing industries—agriculture, manufacturing, construction, and mining—more than 26.9 million in 1970—has increased slowly in recent years. Significant gains in productivity resulting from automation and other technological developments as well as the growing skills of the work force have permitted large increases in output without corresponding increases in employment. Employment in goods-producing industries is expected to increase to about 30 million in 1980, 12 percent above the 1970 level. However, widely different patterns of employment changes have occurred and will continue among the industry divisions in the goods-producing sector.

Agriculture, which until the late 1800's employed more than half of all workers in the economy, employed only 5 percent, or 3.4 million workers, in 1970. Employment in agriculture has dropped by about two-fifths since 1960. Increases in the average size of farms, rapid mechanization, and improved fertilizers, feeds and pesticides have created large increases in output at the same time that employment has fallen sharply.

Agriculture is facing a continuing decline in manpower needs. Factors resulting in past declines will continue and the outlook is for a 1980 farm work force 15 percent lower than in 1970.

Mining employment, at about 620,000 workers in 1970, has declined by nearly 13 percent since 1960, primarily because of labor-saving technological changes and a shift to sources of power other than coal.

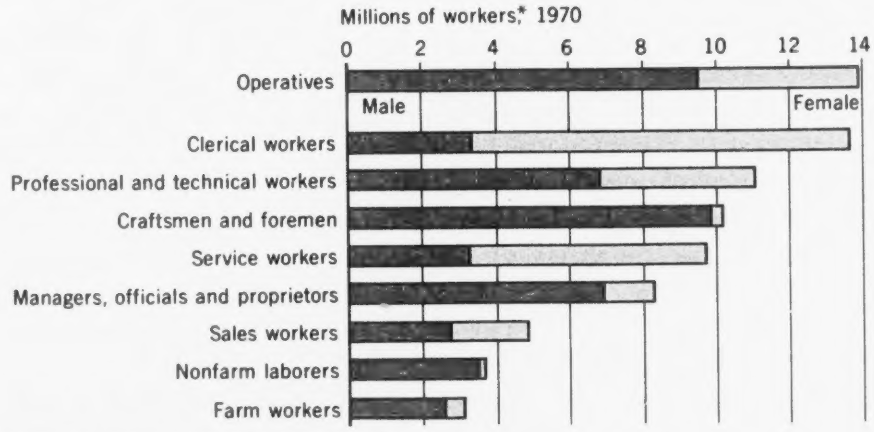
This trend is likely to continue and mining is the only nonagricultural industry division that is not expected to increase between 1970 and 1980. Although minor employment increases are expected in quarrying and other nonmetallic mining, they will be more than offset by continuing declines in the coal mining, and in crude petroleum and natural gas extraction industries. The job level of the entire mining group is expected to decline about 12 percent to about 550,000 between 1970 and 1980.

Contract construction employment, at more than 3.3 million in 1970, has increased more than one-sixth since 1960. The Nation's growing need for homes, offices, stores, highways, bridges, dams, and other physical facilities resulted in this increase in employment.

Between 1970 and 1980, contract construction is expected to grow by about two-fifths to about 4.6 million. Construction activity will be spurred by several factors. An expanding economy will result in more industrial plants and commercial establishments such as office buildings, stores, and banks. The volume of construction maintenance and repair, which is now about one-third of new construction activity, also is expected to grow significantly through the 1970's. Home and apartment building will be stimulated by the increase in population, new family formations, and higher income levels. Also, large government expenditures for urban renewal, school construction, and roads are likely.

Manufacturing, the largest division within the goods-producing sector that had about 19.4 million workers in 1970, increased about 16 percent in employment between 1960 and 1970. New products for industrial and consumer markets and the rapid growth of the defense-space market has spearheaded the post World War II growth.

Manufacturing employment is expected to increase about 13 percent through the 1970's and reach about 21.9 million in 1980. Durable goods manufacturing is projected to increase slightly faster (16 percent) and nondurable goods somewhat slower (9 percent) than the total. However, the rate of growth will vary among the individual manufacturing industries. The machinery in-

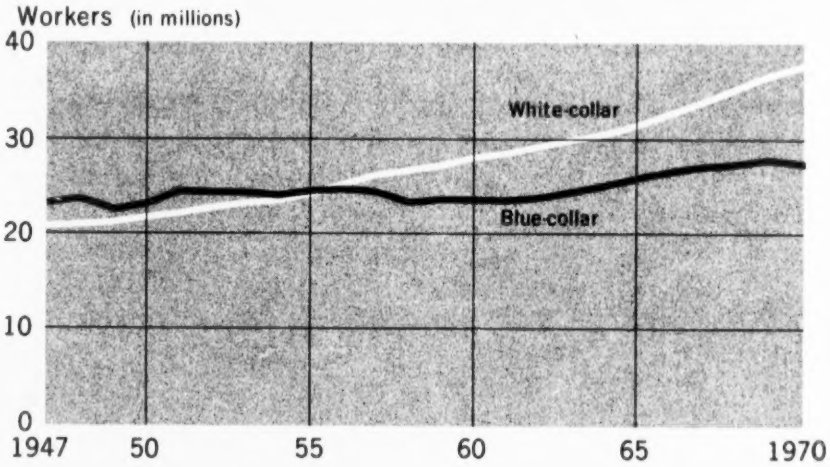


④ Employment in major occupational groups by sex

* INCLUDES SELF-EMPLOYED AND UNPAID FAMILY WORKERS
SOURCE: BUREAU OF LABOR STATISTICS

dustry is expected to have the largest need for additional people, as employment grows from nearly 2.0 million to more than 2.4 million. Producers of rubber and plastic products; furniture and fixtures; stone, clay, and glass products; and instruments, will be among other rapid growing manufacturing industries. In contrast, employment in some manufacturing industries may decline, for example, food, textile mill products, tobacco, and petroleum refining.

⑤ **Employment has shifted toward white-collar occupations**



SOURCE: BUREAU OF LABOR STATISTICS

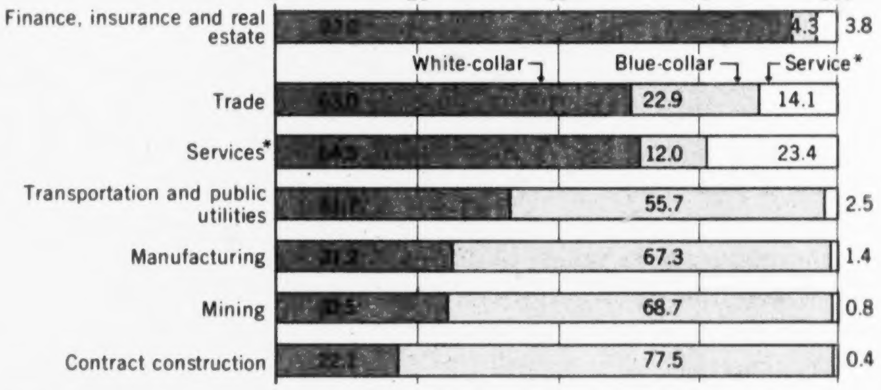
Occupational Profile

As American industries continue to grow large, more complex, and more mechanized, fundamental changes will take place in the Nation's occupational structure. Furthermore, occupations will become more complex and more specialized. Thus, an imposing and confusing number of occupational choices is provided to individuals who are planning their careers. An individual, in examining the vast number of choices should first look at broad groupings of jobs that have similar characteristics such as entrance requirements. (See chart 4.)

Among the most significant changes in the Nation's occupational structure has been the shift toward white-collar jobs. In 1956, for the first time in the Nation's history, white-collar workers—professional, managerial, clerical, and sales—outnumbered blue-collar workers—craftsmen, operatives, and laborers. (See chart 5.)

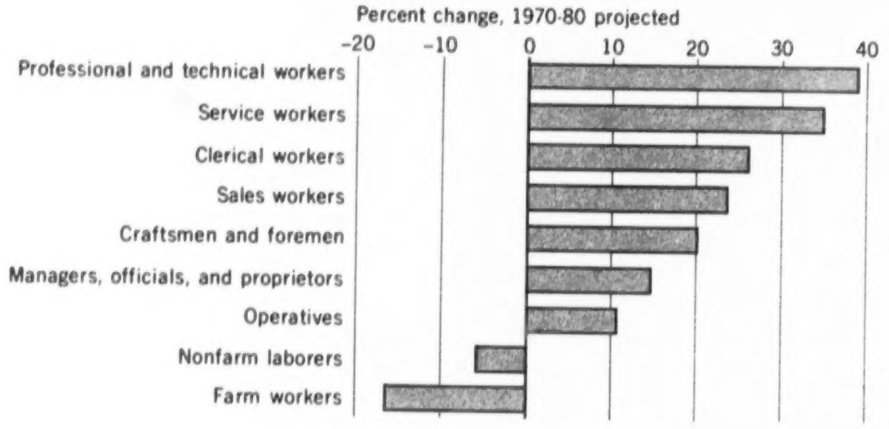
Through the 1970's, we can expect a continuation of the rapid growth of white-collar occupations, a slower than average growth of blue-collar occupations, a faster than average growth among service workers, and a further decline of farm workers. Total employment is expected to increase about 21 percent between 1970 and 1980. In comparison, an increase of about 27 percent is expected for white-collar jobs, and only about 12 percent for blue-collar occupations. By 1980, white-collar jobs will account for more than one-half of all employed workers compared with about 48 percent in 1970. The rapid growth expected for white-collar workers and service workers reflects continuous expansion of the service-producing industries which employ a relatively large proportion of these workers. (See chart 6.) The growing demand for workers to perform research and development, to provide education and health services, and to process the increasing amount of paperwork throughout all types of enterprises, also will be significant in the growth of white-collar jobs. The slower than average growth of blue-collar and farm

⑥ **Industries differ in the kinds of workers they employ**



*EXCLUDES PRIVATE HOUSEHOLD WORKERS
SOURCE: BUREAU OF LABOR STATISTICS

⑦ **During the 1970's, growth will vary widely among occupations**



SOURCE: BUREAU OF LABOR STATISTICS

workers reflects the expanding use of labor-saving equipment in our Nation's industries and the relatively slow growth of the goods-producing industries that employ large proportions of blue-collar workers.

The following section describes in greater detail the changes that are expected to occur among the broad occupational groups through the 1970's.

Professional and technical workers, the third largest occupational group in 1970, include among more than 11.1 million workers such highly trained personnel as teachers, engineers, dentists, accountants, and clergymen.

Professional occupations will be the fastest growing occupation from 1970–80. (See chart 7.) Personnel in this area will be in great demand as the Nation puts greater efforts toward the country's socio-economic progress, urban renewal, transportation, harnessing the ocean, and enhancing the beauty of the land. The quest for scientific and technical knowledge is bound to grow and raise the demand for workers in scientific and technical specialties. The 1970's will see a continuing emphasis in the social sciences and medical services. By 1980 the requirements for professional, technical, and kindred workers may be about two-fifths greater than 1970 employment.

Managers, officials and proprietors totaled about 8.3 million in 1970. As a group they will increase about 15 percent between 1970 and 1980, somewhat slower than the rate of growth for all occupations. As in the past, requirements for salaried managers are likely to continue to increase rapidly because of the increasing dependence of business organizations and government agencies on management specialists. On the other hand, the number of self-employed managers are expected to continue to decline through the 1970's as larger businesses continue to restrict growth of the total number of firms and as supermarkets continue to replace small groceries, general stores, and hand laundries.

Clerical workers numbering 13.7 million in 1970, include workers who operate computers and office machines, keep records, take dictation, and type. Many new clerical positions are expected to open up as industries employing large numbers of clerical workers continue to expand. The trend in retail stores toward transferring to clerical workers functions that were performed by salespersons also will tend to increase employment needs of clerical workers. The demand will be particularly strong for those qualified to handle jobs created by the change of clerical occupations to electronic data processing operations. However, the use of electronic computing bookkeeping machines and other mechanical devices to do processing and repetitive work are expected to reduce the number of clerks employed in jobs such as filing, making up payrolls, keeping tract of inventories, and billing customers. The need for clerical workers as a group is expected to increase more than one-fourth between 1970 and 1980.

Sales workers, accounting for about 4.9 million workers in 1970, are found primarily in retail stores, wholesale firms, insurance companies, real estate agencies, as well as offering goods door to door. Between 1970 and 1980 sales workers are expected to increase nearly 24 percent.

Increasing sales of many new products resulting from rapid population growth, new product development, business expansion, and rising business levels will be the major reason for increasing employment of sales workers. The expected increase in residential and commercial construction and urban renewal will increase the need for real estate agents. Continued extension of such laws as workers' compensation and automobile liability insurance should boost the need for insurance salesmen. The trend of stores to remain open longer hours should increase the need for retail sales persons. However, changes in distribution methods, such as self-service and automatic vending are likely to restrict the employment growth of sales workers.

Craftsmen, numbering about 10.2 million in 1970, include carpenters, tool and die makers, instrument makers, all round machinists, electricians, and type setters. Industrial growth and increasing business activity are the major factors expected to spur the growth of crafts occupations through the 1970's. However, technological developments will tend to limit the expansion of this group. Craftsmen are expected to increase nearly one-fifth, somewhat slower than the growth of all occupations.

Semiskilled workers (operatives) made up the largest major occupational group in 1970 with about 13.9 million workers engaged in assembling goods in factories; driving trucks, buses and taxis; and operating machinery.

Employment for semiskilled workers is expected to increase about 11 percent above the 1970 level, despite continued technological advances that will reduce employment for some types of semiskilled occupations. Increases in production generated by rising population and rapid economic growth, as well as the increasing trend to motor truck transportation of freight, are expected to be the major factors contributing to the increasing employment.

Laborers (excluding those in farming and mining), who numbered nearly 3.7 million workers in 1970, for the most part move, lift, and carry materials and tools in the Nation's workplaces. Employment of laborers is expected to change little between 1970 and 1980 in spite of the rises in manufacturing and construction which employ most laborers. Increased demand is expected to be offset by rising productivity resulting from continuing substitution of mechanical equipment for manual labor.

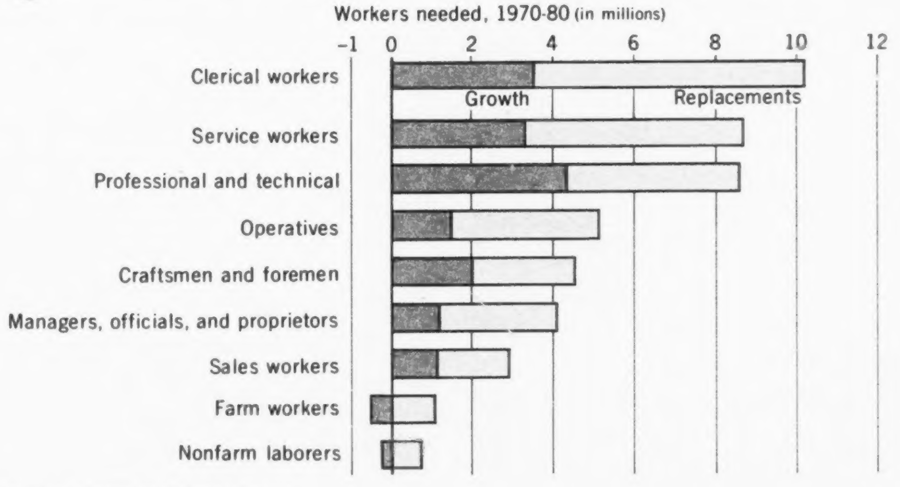
Service workers, including men and women who maintain law and order, assist professional nurses in hospitals, give haircuts and beauty treatments, serve food, and clean and care for our homes, totaled about 9.7 million in 1970. This diverse group will increase about 35 percent between 1970 and 1980 and after professional workers will be the fastest growing group. Some of the main factors that are expected to increase requirements for these occupations are the rising demand for hospital and other medical care; the greater need for protective services as urbanization continues and cities become more crowded; and the more frequent use of restaurants, beauty parlors, and other services as income levels rise and as an increasing number of housewives take jobs outside the home.

Farm workers—including farmers, farm managers, laborers, and foremen—numbered nearly 3.1 million in 1970. Employment requirements for farm workers are expected to decline to about 2.6 million in 1980. This decrease is anticipated, in part, because of continued improvement in farm technology. For example, improved fertilizers, seeds, and feed, will permit a farmer to increase production without increasing employment.

Job Openings

In considering a career, young people should not eliminate occupations just because their preferences will not be among the most rapidly growing. Although growth is a key indicator of future job outlook, more jobs will be created between 1970–80 from deaths, retirements, and other labor force separations than from employment growth. (See chart 8.) Replacement needs will be particularly significant in occupations which have a large proportion of older workers and women. Furthermore, large occupations that have little growth may offer more openings than a fast growing small one. For example, among the major

⑧ **Training needs are determined by replacements plus growth**



SOURCE: BUREAU OF LABOR STATISTICS

occupational groups, openings for operatives resulting from growth and replacement combined will be greater than for craftsmen, although the rate of growth of craftsmen will be more than twice as rapid as the rate of growth for operatives.

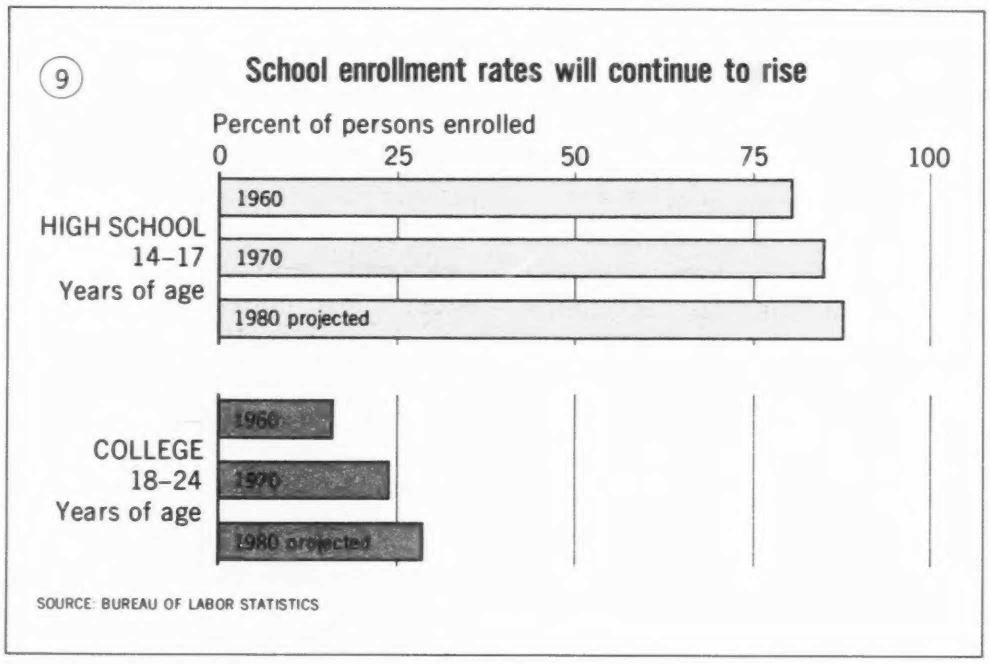
Outlook and Education

Numerous opportunities for employment will be available for jobseekers during the years ahead. Employers are seeking people who have higher levels of education because jobs are more complex and require greater skill. Furthermore, employment growth generally will be fastest in those occupations requiring the most education and training. For example, professional occupations requiring the most education will show the fastest growth through the 1970's. (See chart 7.)

A high school education has become a standard for American workers. Thus, because of personnel practices in American industries, a high school graduate is in a better competitive position in the job market than a nongraduate.

Although training beyond high school has been the standard for sometime for many professional occupations, many other areas of work require more than just a high school diploma. As new automated equipment is introduced on a wider scale in offices, banks, insurance companies, and government operations, skill requirements are rising for clerical and other office jobs. Employers increasingly are demanding better trained workers to operate complicated machinery.

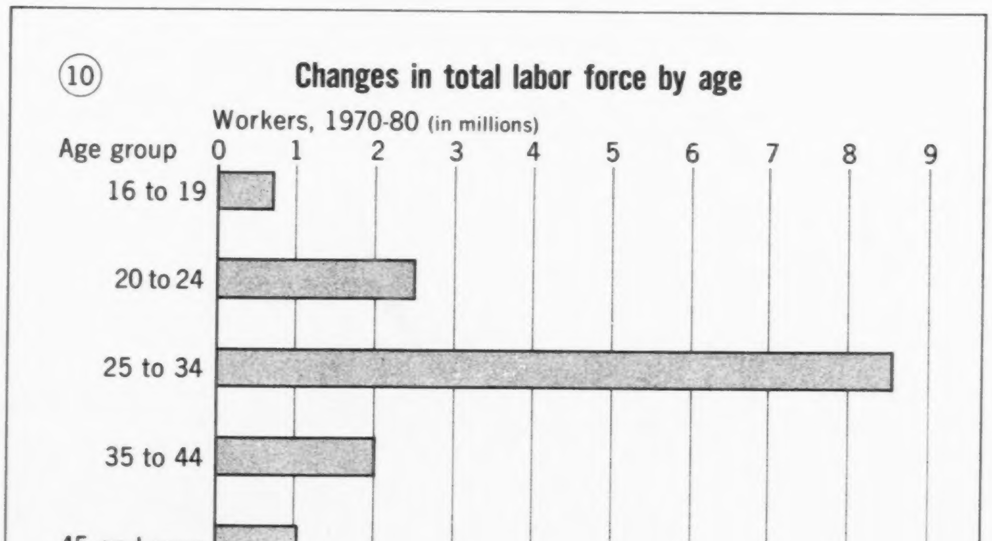
In many areas of sales work, new developments in machine design, use of new materials, and the complexity of equipment are making greater technical knowledge a requirement for demonstrators; and repairmen must become familiar with even more complicated machines.


⑨ School enrollment rates will continue to rise

SOURCE: BUREAU OF LABOR STATISTICS

Along with the demand for greater education, the proportion of youth completing high school have increased and an even larger proportion of high school graduates pursue higher education. (See chart 9.) This trend is expected to continue through the 1970's. In 1980, high school enrollment is expected to be 21.4 million, 7 percent above the 1970 level and college degree credit enrollment is projected at 11.2 million, about 48 percent above the 1970 level of 7.6 million.

The number of persons in the labor force (including those in the Armed Forces) is a related aspect of job competition. Although the number of all workers and job-seekers will increase about 17 percent from 1970 and 1980, the growth in the labor force is really a story of

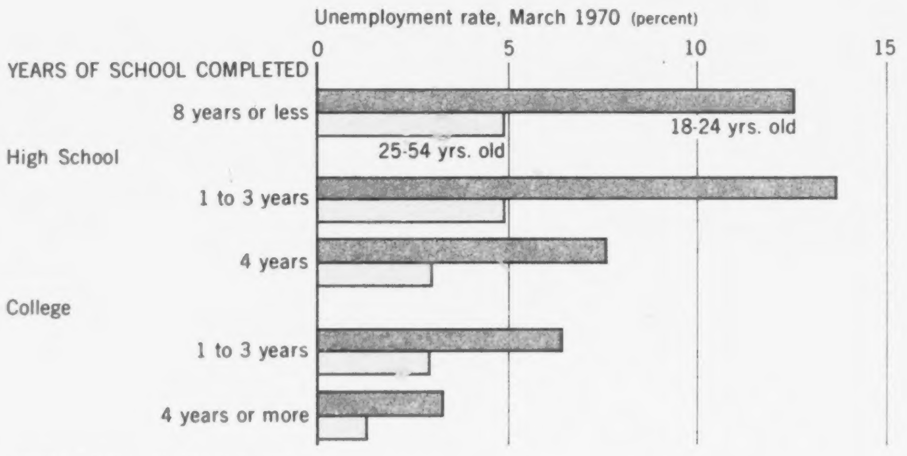

⑩ Changes in total labor force by age

SOURCE: BUREAU OF LABOR STATISTICS

young men and women between 16–34 who will account for about four-fifths of the net increase in workers between 1970 and 1980. (See chart 10.) Thus, in the 1970's the number of young workers will increase and these workers will have more education on the average than new entrants to the labor force in previous years.

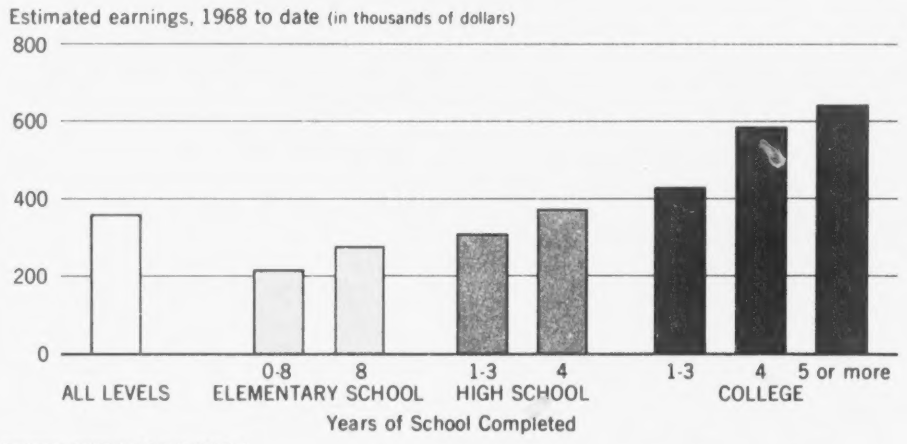
With so much competition from young people who have higher levels of education, the boy or girl who does not get good preparation for work, will find the going more difficult in the years ahead. Employers will be more likely to hire workers who have at least a high school diploma. Furthermore, present experience shows that the less education and training a worker has the less chance he has for a steady job, because unemployment falls heaviest on the worker who has the least education. (See chart 11.)

⑪ Unemployment rates are highest for young workers



SOURCE: BUREAU OF LABOR STATISTICS

⑫ Estimated lifetime earnings for men tend to rise with years of school completed



SOURCE: BUREAU OF THE CENSUS

In addition to importance in competing for a job, education is highly valued in the determination of income. In 1968, men who had college degrees could expect to earn more than $600,000 in their lifetime, or nearly 3 times the $214,000 likely to be earned by workers who had less than 8 years of schooling, nearly twice that earned by workers who had 1 to 3 years of high school, and nearly one and two-thirds as much as high school graduates. Clearly the completion of high school pays a dividend. A worker who had only 1 to 3 years of high school could expect to earn only about $31,000 more than workers who had an elementary school education, but a high school graduate could look forward to a $94,000 lifetime income advantage over an individual completing elementary school. (See chart 12.)

In summary, young people who have acquired a skill or good basic education will have a better chance at interesting work, good wages, and steady employment. Getting as much education and training as one's abilities and circumstance permit therefore should be a top priority for today's youth.

22/23

THE OUTLOOK FOR OCCUPATIONS

PROFESSIONAL AND RELATED OCCUPATIONS

Professional occupations have many attractions for young persons choosing a career. They offer opportunities for interesting and responsible work, and in many cases, lead to high earnings. However, professional work usually can be entered only after a long period of preparation since a broad and thorough knowledge of a field is essential to success in the professions.

More than 11.1 million persons, or about 1 out of every 7 workers, were in professional or related occupations in 1970. These workers accounted for about three-tenths of all white-collar employment.

Professional occupations are of two major types. The larger group, which includes engineer, physician, and teacher, requires specialized and theoretical knowledge. Professions in this group require college graduation—and sometimes an advanced degree—or experience that provides comparable knowledge. The other group, which includes performing artists and athletes, places a high premium on skill and often on creative talent. Academic training generally is of lesser importance in this second group. Licenses are required for practice in many professions—medicine, dentistry, and pharmacy, for example; licensing authorities determine the minimum qualifications for eligibility. Professional societies set up membership standards that tend to define their respective fields.

Women find many employment opportunities in the professions. Almost two-fifths of all professional and related jobs were filled by women in 1970; women predominate in several large professions, including teaching, nursing, library work, and social work.

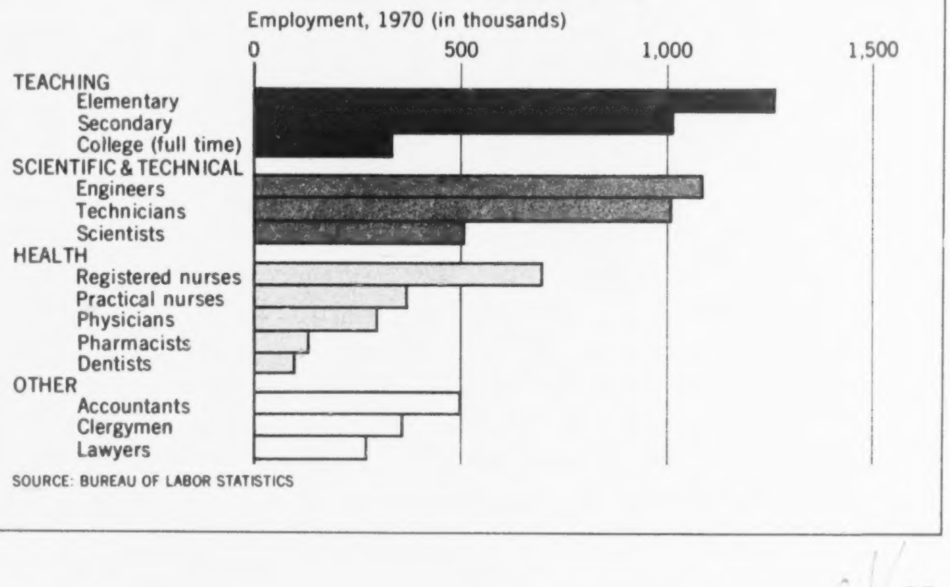
Closely related to the professions is a wide variety of technical occupations. Persons in these occupations work with engineers, scientists, mathematicians, physicians, and other professional personnel. Their job titles include those of draftsman; engineering aid; programer; and electronics, laboratory, or X-ray technician. Employment in these technical occupations usually requires a combination of basic scientific knowledge and specialized education or training in some particular aspect of technology or science. Such training may be obtained in technical institutes, junior colleges, and other schools, or through equivalent on-the-job training.

Many occupations in education, health, social welfare, recreation, library work, and other areas also are related to the professions. Related—and supportive—occupations in these areas include teacher assistant, medical laboratory assistant, social welfare technician, recreation assistant, and library technician. Training for many supportive jobs may be obtained in vocational and technical schools, junior colleges, or sometimes on the job.

The major professional and related occupations are shown in chart 13. As a group, these workers increased by nearly 3.7 million during the 1960–70 decade. The rate of increase, almost 50 percent, was more rapid than for any other occupational group, and two and one-half times the rate for all occupational groups combined. The outlook for professional and related occupations continues to be very favorable. Between 1970 and 1980, employment in this group is expected to increase by nearly two-fifths. (See chart 14.)

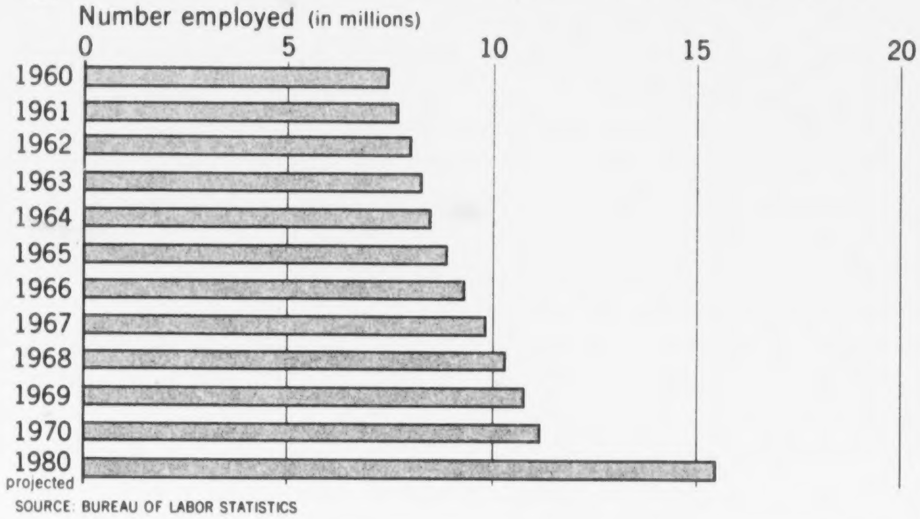
The continuing very rapid growth in the professional worker group is the result of developments such as expansion in research and develop-

⑬ **Elementary teaching and engineering are the largest professional occupations**



SOURCE: BUREAU OF LABOR STATISTICS

⑭ Professional and technical occupations are growing rapidly



SOURCE: BUREAU OF LABOR STATISTICS

ment activities; improvements in standards of living, medical care, and education; and the growing concentration of the population in metropolitan areas—all of which stimulate requirements for highly educated workers. A unique set of factors, however, determines growth in any one occupation. To illustrate, birth rates, school attendance rates, and classroom size are the primary factors in the demand for teachers, whereas primary factors underlying engineering demand include the level of research and development activities and the complexity of industrial processes. In addition, the nature and effect of technological advances on employment requirements vary from profession to profession. Technology in education, such as programmed learning and instructional television, is expected to affect the nature of teaching rather than to exert a strong influence on the level of teacher requirements. In contrast, technological advances in the engineering field are expected to increase requirements for engineers and limit to some extent requirements for the lesser skilled among draftsmen. Although different rates of growth are expected among individual professional occupations because of the varying influence of factors underlying growth, the general tendency will be for a moderate to very rapid growth of these occupations.

Natural scientists are expected to be among the rapidly expanding professions through the 1970's. Chemists, for example, will be required in increasing numbers for research and development and for the manufacture of products such as plastics, man-made fibers, drugs, and high energy and nuclear fuels for missiles and rockets. Demands for physicists also will grow as more are required to perform highly complex research and development work and to satisfy the increasing demand for physicists on college faculties because of the growing importance of physics in engineering and other science curriculums. Requirements for mathematicians are expected to increase markedly, stimulated by the application of systems analysis and computers to a wide range of endeavors and by the use of mathematics in research in fields as diverse as economics and biology. Demands for engineers will rise rapidly in response to industrial expansion, and a variety of programs that include urban renewal, transportation, and environmental protection.

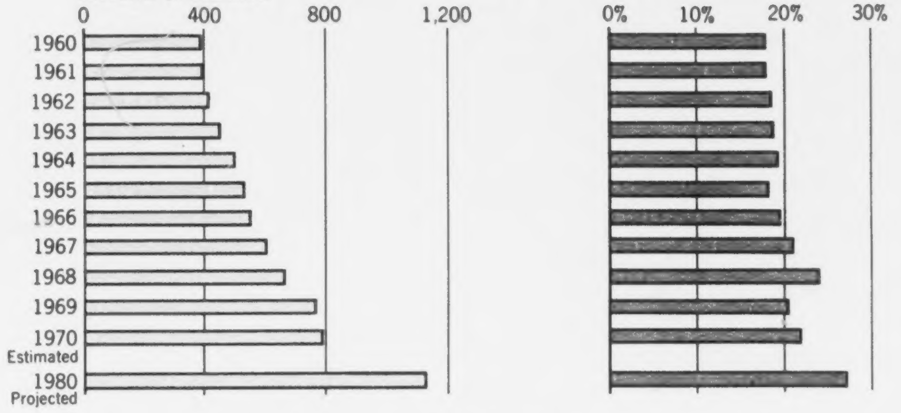
Employment of most types of health workers is also expected to increase rapidly, due to population growth, rising standards of health care, increasing emphasis on preventive medicine and rehabilitation, new drugs and techniques, and wider participation in private health insurance plans and in government programs such as Medicare and Medicaid. In contrast, the employment effect of rising standards in education will be offset partially as declining birth rates begin to affect elementary and secondary school enrollments significantly. However, employment requirements in certain areas of education, such as teachers trained in instructing physically and mentally handicapped and disadvantaged students, are expected to rise. Rapidly increasing college enrollments probably will require large increases in college and university teaching staff.

Social scientist employment is expected to grow rapidly as the solution to social problems is sought increasingly through economics, sociology, psychology, and other social sciences. College trained management personnel, such as accountants, also will be required in larger numbers to cope with the growth in the size and number of firms and their increasing complexity.

Employment of technicians and support personnel in many fields also will increase rapidly with growing emphasis on improving the utilization of professional workers by relieving them of tasks that can be performed by less highly trained personnel.

Educational Trends

Professional occupations accounted for two-thirds of all workers having a college education in 1970. The proportion of all professional workers having a degree has been increasing. In addition to the many professions for which a college education long has been an entry requirement, the demand for graduates at the entry level in other professional, administrative, and related occupations is growing. College graduates are filling many positions that formerly were held by employees who qualified through their experience and personal characteristics rather than by academic studies. Graduates also are working in many professional jobs that did not exist a few decades ago.



⑮ **Number of bachelor's and first professional degrees earned**

Graduates as a percent of all persons 22 years of age

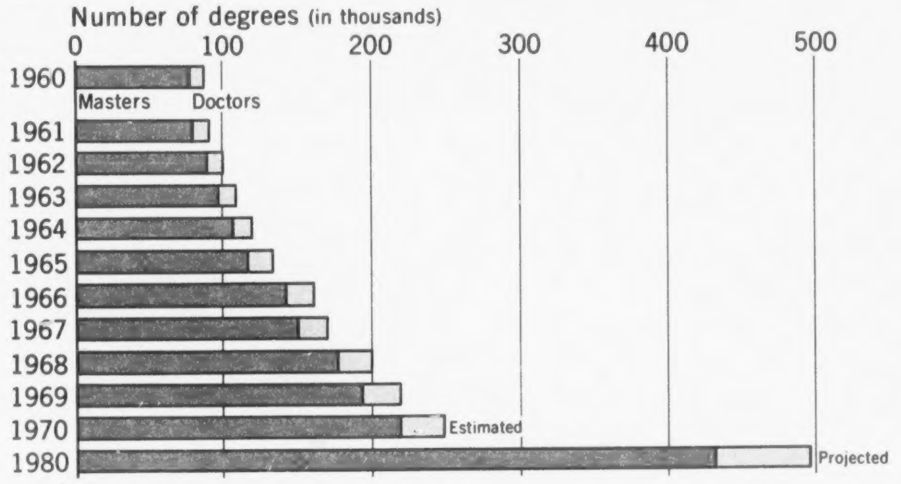
SOURCE: U.S. DEPARTMENT OF HEALTH AND WELFARE, OFFICE OF EDUCATION

Emphasis on a college education will be reinforced in the years ahead as the growing complexity of our society constantly increases the amount of specialized knowledge required for effective performance in many professions. Finally, a college education is becoming necessary for an increasing proportion of jobs, and in many professions the amount of education needed is increasing. A great increase in the number of college graduates, which is the chief source of professionally trained workers, has accompanied the growth in the professional and related occupations. As a percent of all persons 22 years of age, the proportion of young persons completing college rose from 17 percent in 1960 to 22 percent in 1970, as shown on the inset in chart 15.

The rapid increase in the proportion of young people graduating from college reflects a number of basic social trends. Family incomes are higher, enabling more of the young to postpone going to work and to meet the costs of education. More families want a college education for their children. Scholarships and loans are available for more students; part-time work opportunities also are available.

Since these factors probably will continue to be influential in the future, the proportion of young people who graduate from college is expected to go on increasing for many years. The college-age population also is growing. The number of persons age 18 to 21 is expected to increase by nearly 2.7 million between 1970 and 1980. These factors, considered together, indicate a great increase in college graduations, assuming that the Nation's colleges and universities build the classrooms, laboratories, dormitories, and other facilities and hire the faculty needed to provide for the greatly increased number of students. Projections prepared by the U.S. Office of Education indicate an increase from about 785,000 bache-

⑯ **Number of masters and doctor's degrees earned**



SOURCE: U.S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE, OFFICE OF EDUCATION lor's degrees granted in 1970 to more than 1.1 million in 1980. The number of students in graduate school also has risen very rapidly during the last few decades, and probably will continue to mount through the 1970's. A master's degree usually is earned through 1 or 2 years of study beyond the bachelor's degree. The Ph. D. degree usually require 3 years or more beyond the bachelor's degree. As a rule, graduate study is concentrated in the major subject field of the student's interest, whereas undergraduate study is broader in content.

Chart 16 shows the vast increase in graduate degrees awarded during the past 10 years. Master's degrees rose from about 78,000 in 1960 to nearly 220,000 in 1970 and are expected to exceed 430,000 in 1980, if past trends continue. The number of doctorates awarded increased from 9,800 in 1960 to 29,000 in 1970, and may reach over 62,000 by 1980.

Overall analysis of the supply and demand for professional personnel indicates that the outlook for these highly trained workers continues to be excellent. Technicians and supportive personnel generally will have very favorable opportunities.

BUSINESS ADMINISTRATION AND RELATED PROFESSIONS

Many professional workers play a major role in administering businesses and a wide variety of other organizations, both private and governmental. These workers generally need a college degree to qualify for jobs in their respective fields. Though their disciplines are oriented toward business management, they perform functions which are highly specialized and varied. Whether their organizations are small or large, employing only a few people or many thousands, the decisions they make and their effectiveness in implementing these decisions contribute greatly to the success or failure of the enterprise.

This chapter describes some professional occupations that are of vital importance to the Nation's businesses—accountants, advertising workers, marketing research workers, personnel workers, and public relations workers. Workers engaged primarily in managerial duties are covered in the section on *Managerial Occupations* found elsewhere in the *Handbook*.

ACCOUNTANTS

(D.O.T. 160.188)

Nature of the Work

Accountants compile and analyze business records and prepare financial reports, such as profit and loss statements, balance sheets, cost studies, and tax reports. The major fields are public, management, and government accounting. Public accountants are independent practitioners who work on a fee basis for businesses and individuals, or as a member or employee of accountancy firms. Management accountants, often referred to as industrial or private accountants, handle the financial records of the particular firm for which they work on a salary basis. Government accountants work on the financial records of government agencies and often audit the records of private business organizations and individuals whose dealings are subject to government regulations.

Accountants in any field of employment may specialize in such areas as auditing, taxes, cost accounting, budgeting and control, information processing, or systems and procedures. Approximately 100 specialties now exist in the accounting field. Public accountants are likely to specialize in auditing—that is, in reviewing financial records and reports and giving opinions as to their reliability. They also advise clients on tax matters and other financial and accounting problems. Most management accountants are involved in some aspect of providing management with information for decisionmaking. Sometimes they specialize in taxes, budgeting or internal auditing—that is, examining and appraising financial sys-

Accountant reviews financial report.

tems and management control procedures. Many accountants in the Federal Government are employed as Internal Revenue agents, investigators, and bank examiners, as well as in regular accounting positions.

Places of Employment

About 500,000 accountants were employed in 1970, of whom over 100,000 were Certified Public Accountants (CPA's). Accounting is one of the largest fields of professional employment for men. About 2 percent of the CPA's and less than 20 percent of all accountants are women.

More than three-fifths of all accountants do management accounting work. An additional one-fifth are engaged in public accounting as proprietors, partners, or employees of independent accounting firms. Over 10 percent work for Federal, State and local government agencies. A small number teach in colleges and universities.

Accountants are employed wherever business, industrial, or governmental organizations are located. The majority, however, work in large metropolitan centers where there is a particularly heavy concentration of public accounting firms and central offices of large business organizations.

Training, Other Qualifications, and Advancement

Training in accounting can be obtained in universities, 4-year colleges, junior colleges, accounting and private business schools, and correspondence schools. Graduates of all these institutions are included in the ranks of successful accountants; however, a bachelor's degree with a major in accounting or a closely related field is increasingly an asset; for better positions, it may be required. Candidates having a master's degree in accounting, as well as college training in other business and liberal arts subjects, are preferred by many firms.

Previous work experience also can be of great value in qualifying for employment. A number of colleges offer students an opportunity to get such experience through internship programs conducted in cooperation with public accounting or business firms. For beginning accounting positions, the Federal Government requires 4 years of college training (including 24 semester hours in accounting) or an equivalent combination of education and experience. Most universities require the master's degree or the doctorate with the Certified Public Accountancy Certificate for teaching positions.

All States require that anyone practicing in the State as a "certified public accountant" must hold a certificate issued by the State board of accountancy. The CPA examination, administered by the American Institute of Certified Public Accountants, is used by all states to establish certification. In 1970, half the States had laws that required CPA candidates to be college graduates. In recent years, nearly 9 out of 10 successful CPA candidates have been college graduates, and a majority of the remainder have had at least 1 year of college training. Young people interested in an accounting career should be aware that recent reports by the American Institute of Certified Public Accountants indicate that, in the near future, some States may require CPA candidates to have a graduate degree. Before the CPA certificate is issued, at least 2 years of public accounting experience is required by nearly all States.

Considerably more than half the States restrict the title "public accountant" to those who are licensed or registered. Requirements for licensing and registration vary considerably from one State to another. Information on these requirements may be obtained directly from individual State boards of accountancy, or from the National Society of Public Accountants.

Inexperienced accountants usually begin with fairly routine work. Junior public accountants may be assigned to detailed work such as verifying cash balances or inspecting vouchers. They may advance to semisenior positions in 1 or 2 years and to senior positions within another 1 or 2 years. In the larger firms, those successful in dealing with top industry executives often become supervisors, managers, or partners, or transfer to executive positions in private accounting. Some become independent practitioners.

Beginners in management accounting may start as ledger accountants, junior internal auditors, or as trainees for technical accounting positions. They may rise to chief plant accountant, chief cost accountant, budget director, senior internal auditor, or manager of internal auditing, depending on their specialty. Some become controllers, treasurers, financial vice-presidents, or corporation presidents. In the Federal Government, beginners are hired as trainees and usually are promoted in a year or so. In the field of college and university teaching, those having minimum training and experience may receive the rank of instructor without tenure; advancement and permanent faculty status are dependent upon further education.

Accountants who want to get to the top in their profession usually find it necessary to continue their study of accountancy and related problems—even though they already may have obtained college degrees or CPA certificates. Even experienced accountants may spend many hours in study and research in order to keep abreast of legal and business developments that affect their work. More and more accountants are studying computer operation, programing, mathematics, and quantitative methods in order to adapt accounting procedures to new methods of processing business data. Although advancement may be rapid for capable accountants, those having inadequate academic preparation are likely to be assigned to routine jobs and may find themselves handicapped in obtaining promotions.

Employment Outlook

Accounting employment is expected to expand very rapidly during the 1970's because of such factors as the greater use of accounting information in business management; complex and changing tax systems; the growth in size and number of business corporations required to provide financial reports to stockholders; and the increasing use of accounting services by small business organizations. As a result, opportunities for accountants are expected to be excellent. Demand for college-trained accountants will be stronger than the demand for people without this academic background, because of the growing complexity of business accounting requirements. However, graduates of business and other schools which offer thorough training in accounting also should have good job prospects. In addition, the trend toward specialization is creating excellent opportunities for persons trained in a specific phase of accounting. In addition to openings resulting from employment growth, several thousand accountants will be needed annually during this period to replace those who retire, die, or leave the occupation for other reasons.

The computer is having a major effect on the accounting profession. Electronic data processing systems are replacing manual preparation of accounting records and financial statements. As a result, the need for junior accountants at the lower level may be reduced or eliminated. On the other hand, computers can process vast quantities of routine data which will require the employment of additional accountants to analyze the data. Also, the computer is expected to cause radical changes in management information systems and decisionmaking processes in large companies. Additional highly-trained accountants will be required to prepare, administer and analyze the information made available by these systems.

Earnings and Working Conditions

Starting salaries of beginning accountants in private industry were $8,500 a year in 1970, according to a Bureau of Labor Statistics (BLS) survey. Average earnings of experienced accountants ranged between $10,500 and $15,500, depending on their level of responsibility and the complexity of the accounting system. Chief accountants responsible for directing the accounting program of a company or one of its establishments earned between $14,000 and $23,000, depending upon the scope of their authority and size of professional staff.

According to the same survey, beginning auditors averaged $9,000 a year, while experienced auditors' earnings ranged between $11,500 and $14,000.

Salaries are generally 10 percent higher for accountants holding a graduate degree or a CPA certificate. Earnings also are higher for those who are required to travel a great deal.

In the Federal Civil Service the entrance salary for junior accountants and auditors was $8,510 in 1970. Some candidates having superior academic records could qualify for a starting salary of $9,178. Many experienced accountants in the Federal Government earned more than $15,000 a year. Those having administrative responsibilities earned more.

Public accountants are likely to work especially long hours under heavy pressure during the tax season. They do most of their work in their client's offices, and sometimes do considerable traveling to serve distant clients. A few management and government accountants also do much traveling and work irregular hours, but the majority remain in one office and work between 35 and 40 hours a week, under the same general conditions as their fellow office workers.

Sources of Additional Information

Information about CPA's and the aptitude tests now given in many high schools, colleges, and public accounting firms may be obtained from:

American Institute of Certified Public Accountants, 666 Fifth Ave., New York, N.Y. 10019.

Further information on specialized fields of accounting may be obtained from:

National Association of Accountants, 505 Park Ave., New York, N.Y. 10022.

National Society of Public Accountants, 1717 Pennsylvania Avenue NW., Washington, D.C. 20006.

Financial Executives Institute, 50 West 44th St., New York, N.Y. 10036.

The Institute of Internal Auditors, Inc., 170 Broadway, New York, N.Y. 10038.

ADVERTISING WORKERS

(D.O.T. 050.088, 132.088; 141.081 and .168; and 164.068 through .168)

Nature of the Work

Through advertisements, businessmen try to reach potential customers and persuade them to buy their products or services. Advertising workers plan and prepare these advertisements and get them before the public. Advertising workers include executives responsible for planning and overall supervision, copywriters who write the text, artists who prepare the illustrations, and layout specialists who put copy and illustrations into the most attractive arrangement possible. They also include administrative and technical workers who are responsible for the satisfactory reproduction of the "ads," and salesmen who sell advertising space in publications or time on radio and television programs. In a very small advertising organization, one person may handle all these tasks. Large organizations employ specialists for research, copywriting, and layout work. They sometimes have staff members who specialize in writing copy for particular kinds of products or for one type of advertising media. The following are the specialized occupations most commonly found in advertising work.

Advertising managers direct a company's advertising program. They work mostly on policy questions—for example, the type of advertising, the size of the advertising budget, and the agency to be employed. They then work with the agency in planning and carrying through the program. They also may supervise the preparation of special sales brochures, display cards, and other promotional materials.

The advertising manager of a newspaper, radio station, or other advertising medium is concerned chiefly with selling advertising time or space; his functions are similar to those of the sales manager in other businesses.

Account executives employed in advertising agencies handle relations between the agency and its clients. An account executive studies the client's sales and advertising problems, develops a plan to meet the client's needs, and seeks his approval of the proposed program. Account executives must be able to sell ideas and maintain good relations with clients. They must know how to write copy and use artwork, even though copywriters and artists usually carry out their ideas and suggestions.

Some advertising agencies have account supervisors who oversee the work of the account executives. In others, account executives are responsible directly to agency heads.

Advertising copywriters create the headlines, slogans, and text that attract buyers. They collect information about products and the people who might use them. They use psychology and writing techniques to prepare copy especially suited for readers or listeners and for the type of advertising medium to be used. Copywriters may specialize in copy that appeals to certain groups—housewives, businessmen, scientists, engineers—or even in copy that deals with items such as packaged goods or industrial products. In advertising agencies, copywriters work closely with account executives, although they may be under the supervision of a copy chief.

Advertisers and advertising agencies employ *media directors* (or *space buyers* and *time buyers*) to determine where and when advertising should be carried to reach the largest group of prospective buyers at the least cost. They must have a vast amount of information about the cost of advertising in all media and the relative size and characteristics of the reading, viewing, or listening audience which can be reached in various parts of the country by specific publications, broadcasting stations, and other media.

Production managers and their assistants arrange to have the final copy and artwork converted into printed form. They deal with printing, engraving, filming, recording, and other firms involved in the reproduction of advertisements. The production manager must have a thorough knowledge of various printing processes, typography, photography, paper, inks, and related technical materials and processes.

Research directors and their assistants assemble and analyze information needed for effective advertising programs. They study the possible uses of the product, its advantages and disadvantages compared with competing products, and the best ways of reaching potential purchasers. Such workers may make special surveys of the buying habits and motives of customers, or may try out sample advertisements to find the most convincing selling theme or most efficient media for carrying the advertising message. The research director is an important executive in advertising organizations. More information on this occupation is contained in the statement on Marketing Research Workers.

Artists and layout men work closely with advertising managers, copywriters, and other advertising personnel in planning and creating visual effects in advertisements. More information about this group appears in the separate statements on Commerical Artists and Photographers.

Places of Employment

In 1970, more than 140,000 men and women were employed in positions requiring considerable knowledge of advertising. More than one-third of these workers are employed in advertising agencies, and more than half of the agency workers are employed in the New York City and Chicago metropolitan areas. However, there are many independent agencies in other cities, and many leading agencies operate branch offices outside the major centers.

Advertising workers not employed in advertising agencies work for manufacturing companies, stores, and other organizations having products or services to sell; for advertising media, such as newspapers and magazines; and for printers, engravers, art studios, product and package designers, and others who provide services to advertisers and advertising agencies.

Training, Other Qualifications, and Advancement

Most employers, in hiring advertising trainees, prefer college graduates having liberal arts training or majors in advertising, marketing, journalism, or business administration. However, there is no typical educational background for success in advertising. Some successful advertising people have started in such varied occupations as engineer, teacher, chemist, artist, or salesman.

Most advertising jobs require a flair for language, both spoken and written. Since every assignment requires individual handling, a liking for problem-solving also is very important. Advertising personnel should have a great interest in people and things to help them sell their ideas to their superiors, to advertisers, and to the public. They must be able to accept criticism and to gain important points with tact.

Young people planning to enter advertising should get some experience in copywriting or related work with their school publications and, if possible, through summer jobs connected with marketing research services. Some large advertising organizations recruit outstanding college graduates and train them through programs which cover all aspects of advertising work. Most beginners, however, have to locate their own jobs by applying directly to possible employers. Some start as assistants in research or production work or as space or time buyers. A few begin as junior copywriters. One of the best avenues of entrance to advertising work for women is through advertising departments in retail stores.

Employees having initiative, drive, and talent may progress from beginning jobs to creative, research, or managerial work. Management positions require experience in all phases of the advertising business.

Copywriters and account executives can usually look forward to rapid advancement if they demonstrate exceptional ability in dealing with clients, since the success of an advertising organization depends upon satisfied advertisers. Many of these workers prefer to remain in their own specialities and for them advancement is to more responsible work at increased pay. Some top-flight copywriters and account executives establish their own agencies.

Employment Outlook

Employment of advertising workers is expected to increase slowly through the 1970's. Opportunities should be favorable, however, for highly qualified applicants, especially in advertising agencies, as more and more advertisers turn their work over to agencies. However, many young people attracted to advertising will face stiff competition for entry jobs in this field through the 1970's. Most openings —several thousand each year—will result from the need to replace those who retire, die, or leave the occupation for other reasons.

Earnings and Working Conditions

According to the limited information available, starting salaries for beginning advertising workers ranged from $6,500 to $8,000 a year in 1970. The higher starting salaries were paid most frequently in very large firms that recruit outstanding college graduates; the lower salaries were earned in stores and small advertising agencies.

Salaries of experienced advertising workers employed by advertising agencies vary by size of firm. The average salary paid by small agencies (those having annual billings between $250,000 and $1 million) was $11,000 a year in 1970. Advertising workers employed by large agencies (those having billings between $20 million and $40 million) averaged $26,000 a year. Salaries also vary by function. For example, account executives employed by small agencies averaged $13,000 a year, while media directors averaged less than $7,000 a year in agencies of the same size.

Advertising workers frequently work under great pressure. Working hours are sometimes irregular because deadlines must be met and last minute changes are not uncommon. Persons in creative jobs often work evenings and weekends to finish important assignments.

At the same time, advertising is a satisfying career for persons who enjoy variety, excitement, and a constant challenge to their creative ability, and who can meet the competition. Advertising workers have the satisfaction of seeing their work in print and on television, or hearing it over the radio, even though they remain unknown to the public at large.

Sources of Additional Information

American Advertising Federation, 1225 Connecticut Ave. NW., Washington, D.C. 20036.

American Association of Advertising Agencies, 200 Park Ave., New York, N.Y. 10017.

Association of Industrial Advertisers, 41 East 42nd Street, New York, N.Y. 10017.

A list of schools which provide training in advertising may be obtained from:

Advertising Education Publications, 3429 Fifty-Fifth Street, Lubbock, Texas 79413.

MARKETING RESEARCH WORKERS

(D.O.T. 050.088)

Nature of the Work

Marketing research workers provide businessmen with much of the information they need to make decisions about marketing new and existing goods and services. In doing this, marketing research workers collect, analyze, and interpret many different kinds of information. They prepare reports and recommendations on such widely differing problems as forecasting sales; selecting a brand name, package, or design; choosing a new plant location; deciding whether to move goods by rail, truck, or other method; and determining the kinds of advertising likely to attract the most business. In investigating these and other matters, they consider expected changes in subjects relevant to marketing policies such as population, income, and consumer credit policies.

Most marketing research starts with the collection of facts from published materials, the firm's own records, and specialists on the subject under investigation. For example, marketing research workers analyzing fluctuations in their company's sales may begin by determining periodic changes in sales volume in several different cities. They may then compare these fluctuations with changes in population, income, the size of the company's sales force, and the amounts the company has spent for advertising in each city, and thus discover the reasons for changes in the volume of sales. Other marketing research workers may study changes in the quantity of company goods on store shelves, or make door-to-door surveys to learn the number of company products already used in households.

Marketing research is often concerned with the opinions and likes and dislikes of customers. For example, to help management decide on the design and price of a new line of television sets, a survey of consumers may determine the price they would be willing to pay and their preferences as to color and size of the set.

Such a survey is usually conducted under the supervision of marketing research workers who specialize in research on consumer goods—that is, merchandise sold to the general public. In designing the survey, the marketing research worker may be assisted by a statistician in selecting a group (or "sample") of people to be interviewed to make sure that their opinions represent those held by most potential customers. He may also consult a "motivational research" specialist who knows how to frame questions that will produce reliable information on what motivates people to buy. Once the investigation is underway, the marketing research worker may supervise the interviewers who call on consumers to obtain answers to the questions. He may also direct the work of the office employees who tabulate and analyze the information collected. His report summarizing the survey findings also may include other information that company officials need in making decisions about marketing of old or new product lines.

Marketing research worker plans location of test market.

Marketing research surveys concerned with products used by business and industrial firms may be conducted somewhat differently from consumer goods surveys. Because research on some industrial products requires interviewers with a technical knowledge of the product involved, the marketing research worker (or several research workers if it is an extensive survey) often conducts the interviews. In his interviews, he not only seeks opinions about the product—existing or newly developed—but also possible new ways of adapting it to industrial needs. He must, therefore, be a specialist both in marketing research and in the industrial uses of the product involved.

Places of Employment

More than 20,000 marketing research workers were employed full time in 1970. This number included research assistants and others in junior positions, as well as research supervisors and directors. Most of these workers were men. In addition, a limited number of other professionals (statisticians, economists, psychologists, and sociologists) and several thousand clerical workers (clerks who code and tabulate survey returns, typists, and others) were employed full time in this field. Thousands of additional workers, many of them women, were employed on a part time or temporary basis as survey interviewers.

Among the principal employers of marketing research workers are manufacturing companies and independent advertising and marketing research organizations which do this kind of work for clients on a contract basis. Marketing research workers are also employed by very large stores, radio and television firms, and newspapers; others work for university research centers, government agencies, and other organizations which provide information for businessmen. Marketing research organizations range in size from one-man enterprises to large firms having a hundred employees or more.

The largest number of marketing research workers is in New York City, where many major advertising and independent marketing research organizations are located, and where many large manufacturers have their central offices. The second largest concentration is in Chicago. However, marketing research workers are employed in many other cities—wherever there are central offices of large manufacturing and sales organizations.

Training, Other Qualifications, and Advancement

A bachelor's degree is the usual requirement to become a marketing research trainee. A master's degree in business administration is becoming increasingly desirable, especially for advancement to higher level positions. Many people qualify for marketing research jobs through previous experience in other research or in work related to marketing. University teachers of marketing research or statistics sometimes are sought by employers to head new marketing research departments.

College courses considered valuable as preparation for work in marketing research are marketing, statistics, English composition, speech, psychology, and economics. Candidates for some marketing research positions need specialized training in engineering or other technical subjects, or substantial sales experience and a thorough knowledge of the company's products. Knowledge of electronic data-processing procedures is becoming important because of the growing use of computers in sales forecasting, distribution, cost analysis, and other aspects of marketing research. Graduate training may be necessary for some kinds of work—for example, motivational research or sampling and other statistical techniques connected with large-scale surveys.

Trainees in marketing research usually start as research assistants or junior analysts. At first, they are likely to do considerable clerical work, such as copying data from published sources, editing and coding questionnaires, and tabulating survey returns. They also learn how to conduct interviews and how to write reports on survey findings.

As they gain experience, assistants and junior analysts may advance to higher level positions with responsibility for specific marketing research projects, or to supervisory positions. An exceptionally able individual may eventually become marketing research director or vice president for marketing and sales.

Marketing research workers must have exceptional ability to recognize and define problems, and imagination and ingenuity in applying marketing research techniques to their solution. They should be able to adapt to change since they are constantly faced with new and different problems. Above all, their work calls for the ability to analyze information and to write reports which will convince management of the significance of the information.

Employment Outlook

College graduates trained in marketing research and statistics are likely to find favorable job opportunities in this occupation through the 1970's. The growing complexity of marketing research techniques will also expand opportunities for psychologists, economists, and other social scientists. Advanced degrees are becoming increasingly necessary for employment in marketing research, and as a result, job opportunities for holders of Masters and Ph. D degrees will be excellent.

The demand for marketing research services is expected to increase very rapidly through the 1970's. It is expected that existing marketing research organizations will expand and that new marketing research departments and independent research firms will be set up. Business managers will find it increasingly important to obtain the best information possible for appraising marketing situations and planning marketing policies. Furthermore, as marketing research techniques improve and more statistical data accumulate, company officials are likely to turn more often to marketing research workers for information and advice. In addition to growth needs, many openings will occur each year as persons retire, die, or leave the field for other reasons.

Earnings and Working Conditions

Starting salaries for market research trainees averaged about $8,500 a year in 1970, according to the limited data available. Persons having masters degrees in Business Administration and related fields usually started at about $12,000 a year. Those with a technical background received slightly higher salaries.

Earnings were substantially higher for experienced marketing research workers who attained positions with considerable responsibility. In 1970, earnings of senior analysts were $15,000 a year. Marketing research directors' average salaries were about $20,000 annually; and vice-presidents in charge of marketing received salaries between $25,000 and $30,000 a year.

Marketing research workers usually work in modern, centrally located offices. Some, especially those employed by independent research firms, do a considerable amount of traveling in connection with their work. Also, they may frequently work under pressure and for long hours to meet deadlines.

Sources of Additional Information

Information about specialized types of marketing research is contained in a report entitled "Marketing Research Procedures, A Small Business Bibilography, Number 9" which may be obtained from:

Small Business Administration, Washington, D.C. 20416.

Additional information on marketing research may be obtained from:

American Marketing Association, 230 North Michigan Avenue, Chicago, Illinois 60601.

PERSONNEL WORKERS

(D.O.T. 166.088 through .268)

Nature of the Work

Attracting and keeping the best employees available, and matching them to jobs they can do effectively are important for the successful operation of business and government. Personnel workers are responsible for helping their employers attain these objectives. They develop recruiting and hiring procedures and interview job applicants, selecting or recommending the ones they consider best qualified for the openings to be filled. In addition, personnel workers counsel employees, deal with disciplinary problems, classify jobs, plan wage and salary scales, develop safety programs, and conduct research in personnel methods. Other important aspects of their work involve employee-management relations, employee training, and the administration of employee benefit plans.

Some personnel jobs require only limited contact with people; others involve frequent contact with employees, union representatives, job applicants, and other people in and outside the company.

Business organizations with large personnel departments employ personnel workers at varying levels of responsibility. Usually the department is headed by a director who formulates personnel policy, advises other company officials on personnel matters, and administers his department. Within the department, supervisors and various specialists —in wage administration, training, safety, job classification, and other aspects of the personnel program —may be responsible for the work of staff assistants and clerical employees. Small business organizations employ relatively few personnel workers. Sometimes one person may be responsible for all the personnel activities as well as other types of duties.

Personnel workers in Federal, State, and local government agencies do much the same kind of work as those employed in large business firms. Government personnel workers, however, spend considerably more time in activities related to classifying jobs, and in devising, administering, and scoring the competitive examinations given to job applicants.

Places of Employment

Personnel workers are employed in nearly all kinds of business enter-

Interviewing job applicants is an important responsibility in personnel work.

prises and government agencies. The total number employed in 1970 was estimated to be about 160,000. Well over half of all personnel workers were employed by private firms. Large numbers also were employed by Federal, State, and local government agencies. A small group of personnel workers were in business for themselves, often as management consultants or employee management relations experts. In addition, colleges and universities employed some professionally trained personnel workers as teachers of courses in personnel administration, industrial relations, and similar subjects.

Most personnel workers are employed in large cities and in the highly industrialized sections of the country. Almost three-fourths of all personnel workers are men. Many women, however, occupy personnel positions in organizations that employ large numbers of women workers—for example, in department stores, telephone companies, insurance companies, banks, and government agencies.

Training, Other Qualifications, and Advancement

A college education is becoming increasingly important for entrance into personnel work. Some employers hire new graduates for junior positions, and then provide training programs to acquaint them with their operations, policies, and problems.

Other employers prefer to fill their personnel positions by transferring people who already have firsthand knowledge of operations. A large number of the people now in personnel work who are not college graduates entered the field in this way.

Many employers in private industry prefer college graduates who have majored in personnel administration; others prefer graduates who have a general business administration background. Still other employers consider a liberal arts education the most desirable preparation for personnel work. Young people interested in personnel work in government are advised to major in public administration, political science, or personnel administration; however, those having other college majors also are eligible for personnel positions in government.

For some positions, more specialized training may be necessary. Jobs involving testing or employee counseling often require a bachelor's degree with a major in psychology and sometimes a graduate degree in this field. An engineering degree may be desirable for work dealing with time studies or safety standards, and a degree with a major in industrial relations may be helpful for work involving employee management relations. A background in accounting may be useful for positions concerned with wages or pension and other employee benefit plans.

After the initial period of orientation, through formal or on-the-job training programs, college graduates may progress to classifying jobs, interviewing applicants, or handling other personnel functions. After they have gained experience, those with exceptional ability may be promoted to executive positions, such as personnel director. Personnel workers sometimes advance by transferring to other employers having larger personnel programs or from a middle-rank position in a big organization to the top job in a smaller one.

Personal qualities regarded as important for success in personnel work include the ability to speak and write effectively and a better-than-average aptitude for working with people of all levels of intelligence and experience. In addition, the prospective personnel worker should be the kind of person who can see the employee's point of view as well as the employer's, and should be able to give advice in the best interests of both. A liking for detail, a high degree of persuasiveness, and a pleasing personality also are important.

Employment Outlook

College graduates who enter personnel work are expected to find many opportunities through the 1970's. Although employment prospects will probably be best for college graduates who have specialized training in personnel administration, positions will be available also for people having degrees in other fields. Opportunities for young people to advance to personnel positions from production, clerical, or subprofessional jobs will be limited.

Employment in personnel work is expected to expand very rapidly as the Nation's employment rises. More personnel workers will be needed to carry on recruiting, interviewing, and related activities. Also, many employers are recognizing the importance of good employee relations, and are depending more heavily on the services of trained personnel workers to achieve this.

Employment in some specialized areas of personnel work will rise faster than others. More people will probably be engaged in psychological testing; the need for workers to handle work related problems will probably continue to increase; and the growth of employee services, safety programs, other benefit plans, and personnel research also is likely to continue.

Earnings and Working Conditions

A national survey indicated that the average annual salary of trainees employed as job analysts in private industry was about $9,000 in 1970; experienced job analysts averaged about $13,000; directors of personnel generally earned between $12,500 and $22,000; and some top personnel and industrial relations executives in very large corporations earned considerably more.

In the Federal Government, inexperienced graduates having bachelor's degrees started at $6,548 a year in 1970; those having exceptionally good academic records or master's degrees began at $8,098; a few master's degree holders who ranked high in their respective classes received $9,881 a year. Federal Government personnel workers with higher levels of administrative responsibility and several years of experience in the field were paid more than $16,500; some in charge of personnel for major departments of the Federal Government earned more than $22,500 a year.

Employees in personnel offices generally work 35 to 40 hours a week. During a period of intensive recruitment or emergency, they may work much longer. As a rule, personnel workers are paid for holidays and vacations, and share in the same retirement plans and other employee benefits available to all professional employees in the organizations where they work.

Sources of Additional Information

General information on personnel work as a career may be obtained by writing to:

American Society for Personnel Administration, 19 Church St., Berea, Ohio 44017.

Information about government careers in personnel work may be obtained from:

Public Personnel Association, 1313 East 60th St., Chicago, Ill. 60637.

PUBLIC RELATIONS WORKERS

(D.O.T. 165.068)

Nature of the Work

All organizations want to present a favorable image to the public. Public relations workers help an employer build and maintain such a public image. To accomplish this, they must keep themselves informed about the attitudes and opinions of customers, employees, and other groups.

Public relations workers provide information about an employer's business to newspapers and magazines, radio and television, and other channels of communication. They plan the kind of publicity that will be most effective, contact the people who may be interested in using it, and prepare and assemble the necessary material. Many newspaper items, magazine articles, and pamphlets giving various information about a company start at public relations workers' desks. These workers also arrange speaking engagements for company officials and

Public relations worker checks material for press release.

write the speeches they deliver. They often serve as an employer's representative during community projects and ocasionally may perform duties such as showing a film at a school assembly, staging a beauty contest, or planning a convention.

Public relations workers tailor their programs to an employer's particular needs. In a business firm, public relations work usually concerns an employer's relationships with employees, stockholders, government agencies, and community groups.

Public relations staffs in large firms sometimes number 200 or more. The director of public relations may share responsibility for developing overall plans and policies with a company vice president or another top executive having the authority to make final decisions. In addition to writers and research workers, public relations departments employ specialists who prepare material for the different media or write reports sent to stockholders.

Public relations workers who handle publicity for an individual, or direct public relations for a university or small business, may perform all aspects of the work. They make contacts with outsiders, do the necessary planning and research, and prepare material for publication. These workers may combine public relations duties with advertising or other managerial work; and they may be top-level officials or occupy less important positions.

Places of Employment

About 75,000 public relations workers were employed in 1970, according to the limited data available. Over one-fourth were women. In recent years, an increasing number of women have entered public relations work.

Most public relations workers are employed by manufacturing firms, stores, public utilities, trade and professional associations, and labor unions. Others are employed by consulting firms providing public relations services to clients for a fee.

Employment in public relations work is concentrated in large cities where press services and other communications facilities are readily available, and where large corporations and trade and professional associations have their headquarters. More than half of the public relations consulting firms in the United States are in New York City, Los Angeles, Chicago, and Washington, D.C.

Training, Other Qualifications, and Advancement

Although college education generally is regarded as the best preparation for public relations work, employers differ in the specific type of college background they require of applicants. Some seek graduates who have majored in English, journalism, or public relations; others prefer candidates having a background in science or another field related to the firm's business activities.

College graduates who have secretarial skills also are desired by some employers, especially in small firms, because they can combine secretarial duties with public relations work. After a few years' experience, these workers may advance to a full-time public relations position.

In 1970, 20 colleges offered a bachelor's degree in public relations, and 18 offered advanced degrees. In addition, about 300 colleges offered at least one course in public relations.

College subjects recommended as preparation for a public relations career include journalism, economics and other social sciences, business administration, psychology, public speaking, literature, and physical sciences. Extracurricular activities such as work on school publications or student government activities furnish valuable experience; part-time or summer employment in selling, public relations, or a related field such as broadcasting also are helpful.

Among the personal qualifications usually considered important are creativity, initiative, drive, and the ability to express thoughts clearly and simply. Fresh ideas are so important to effective public relations that some experts spend all of their time developing ideas but take no active part in carrying out programs. In selecting new employees, many employers prefer people having previous work experience, particularly in journalism or a related field.

Some companies—particularly those with large public relations programs—have formal training programs for new employees. In other companies, new employees learn by working under the guidance of experienced staff members. Beginners often maintain files of material about company activities, scan newspapers and magazines for appropriate articles to clip, and assemble information for speeches and pamphlets. After gaining experience, they may be given progressively more difficult assignments, such as writing press releases, speeches, and articles for publication. Promotion to supervisory and managerial positions may come as the worker demonstrates ability to handle more difficult and creative assignments. The most skilled public relations work, which involves developing overall plans and maintaining contacts, usually is performed by the department director and his most experienced staff members. Some experienced public relations workers establish their own consulting firms.

Employment Outlook

Employment in this field is expected to expand rapidly through the 1970's. In addition to the new jobs created as expanding organizations require more public relations specialists, openings will occur because of the need to replace workers who retire or leave the field for other reasons.

The demand for public relations workers is expected to grow through the 1970's, as population increases and the general level of business activity rises. In recent years, the amount of funds spent on public relations has increased, and many organizations have developed new public relations departments. This trend should continue in the years ahead.

Earnings and Working Conditions

Starting salaries for public relations trainees ranged from $4,600 to $7,500 a year in 1970, according to the limited data available. The highest starting salaries were paid by consulting firms in major cities to workers who were very well qualified from the standpoint of educational background and previous work. Many public relations workers having a few years of experience earn between $9,000 and $13,000 a year.

The salaries of experienced workers generally are highest in large organizations having extensive public relations programs. In 1970, directors of public relations employed by medium-size firms generally earned $14,000 to $18,000 annually; those employed by large corporations had salaries in the $15,000 to $25,000 range, according to the Public Relations Society of America. Some officials, such as vice presidents in charge of public relations, earned from $25,000 to $50,000 a year or more. Many consulting firms employ large staffs of experienced public relations specialists and often pay somewhat higher salaries than those paid by other business organizations. In social welfare agencies, nonprofit organizations and universities, salaries are somewhat lower.

The workweek for public relations personnel usually is 35 to 40 hours. Irregular hours and overtime often may be necessary, however, to prepare or deliver speeches, attend meetings and community functions, and travel out of town. Occasionally, the nature of their regular assignments or special events require public relations workers to be on call around the clock.

Sources of Additional Information

The Information Center, Public Relations Society of America, Inc., 845 Third Ave., New York, N.Y. 10022.

Service Department, Public Relations News, 127 East 80th Street, New York, N.Y. 10021.

CLERGYMEN

The choice of the ministry, priesthood, or rabbinate as one's lifework involves considerations that do not influence to the same degree the selection of a career in most other occupations. When young people decide to become clergymen, they do so primarily because of their religious faith and their desire to help others. Nevertheless, it is important for them to know as much as possible about the profession and how to prepare for it, the kind of life it offers, and its needs for personnel. They also should understand that the civic, social, and recreational activities of clergymen often are influenced, and sometimes restricted, by the customs and attitudes of the community.

The number of clergymen needed is broadly related to the size and geographic distribution of the Nation's population and participation in organized religious groups. These factors affect the number of churches and synagogues that are established and thus the number of pulpits to be filled. In addition to the clergy who serve congregations, many others teach in seminaries and other educational institutions, serve as chaplains in the Armed Forces, or work as missionaries.

Young persons considering careers as clergymen should seek the counsel of a religious leader of their faith to aid in evaluating their qualifications. The most important requisite, of course, is the desire to serve the spiritual needs of others. To deal effectively with all types of persons, clergymen need to be well-rounded and able to speak and write effectively. Emotional stability and sensitivity to the problems of others also are essential. Clergymen are expected to have high moral and ethical standards.

The size and financial status of the congregation to a large extent determines income. Usually pay is highest in large cities or prosperous suburban areas. Earnings usually rise with increased experience and responsibility. Most Protestant churches and a number of Jewish congregations provide housing. Roman Catholic priests ordinarily live in the parish rectory or their religious order provides housing. Many clergymen receive transportation allowances or other expenses. Gifts or fees for officiating at special ceremonies, such as weddings, may be an important source of additional income; however, clergymen frequently donate such earnings to charity. Some churches establish a uniform fee for special services which goes directly into the church treasury.

More detailed information on the clergy in the three largest faiths in the United States—Protestant, Roman Catholic, and Jewish—is given in the following statements that were prepared in cooperation with leaders of these faiths. Information on the clergy in other faiths may be obtained directly from leaders of the respective groups. Numerous other church-related occupations—those of the missionary, teacher, director of youth organizations, director of religious education, editor of religious publications, music director, church secretary, recreation leader, and many others—offer interesting and satisfying careers. In addition, opportunities to work in connection with religious activities are present in many other occupations. Clergymen or educational directors of local churches or synagogues can provide information on the church-related occupations and other areas offering opportunities for religious service.

PROTESTANT MINISTERS

(D.O.T. 120.108)

Nature of the Work

Protestant ministers lead their congregations in worship services and may administer the rites of baptism, confirmation, and Holy Communion. They prepare and deliver sermons and give religious instruction to persons who are to be received into membership of the church. They also perform marriages, conduct funerals, counsel individuals who seek guidance, visit the sick and shut-in, comfort the bereaved, and serve their church members in many other ways. Protestant ministers also may write articles for publication, give speeches, and engage in interfaith, community, civic, educational, and recreational activities sponsored by or related to the interests of the church. Some ministers teach in seminaries, colleges, and universities.

The types of worship services that ministers conduct differ among Protestant denominations and also among congregations within a denomination. In some denominations, ministers follow a traditional order of worship; in others they adapt the services to the needs of youth and other groups within the congregation. Most services include Bible reading, hymn singing, prayers, and a sermon. Bible reading by a member of the congregation and individual testimonials may constitute a large part of the service in some demoninations.

Ministers serving small congregations generally work on a personal basis with their parishioners. Those serving large congregations usually have greater administrative responsibilities and spend considerable time working with committees, church officers, and staff, besides performing their other duties. They may have one or more associates or assistants who share specific aspects of the ministry, such as a Minister of Education who assists in educational programs for different age groups.

Places of Employment

In 1970, about 295,000 ministers served over 71 million Protestants. In addition, thousands of ministers were in other occupations closely related to the parish ministry. The greatest number of clergymen are affiliated with the five largest groups of churches—Baptist, United Methodist, Lutheran, Presbyterian, and Episcopal. Most ministers serve individual congregations; some are engaged in missionary activities in the United States and in foreign countries; others serve as chaplains in the Armed Forces, in hospitals, and in other institutions. Still others teach in educational institutions, engage in other religious educational work, or are employed in social welfare and related agencies. Less than 5 percent of all ministers are women; however, about 80 denominations ordain women. In some denominations, an increasing number of women who have not been ordained are serving as pastors' assistants.

All cities and most towns have one Protestant church or more with a full-time minister. The majority of ministers are located in urban areas. Many others live in less densely populated areas where each may serve two congregations or more. A larger proportion of Protestants than members of other faiths live in rural areas.

Training and Other Qualifications

The educational preparation required for entry into the Protestant ministry has a wider range than for most professions. Some religious groups have no formal educational requirements, and others ordain persons having varying amounts and types of training in liberal arts colleges, Bible colleges, or Bible institutes. An increasingly large number of denominations, however, require a 3-year course of professional study in a theological school following college graduation. After completion of such a course, the degree of bachelor or master of divinity is awarded.

In 1970, 112 of the theological institutions in the Nation were accredited by the American Association of Theological Schools. Accredited institutions admit only students who have received the bachelor's degree or its equivalent from an approved college. In addition, certain character and personality qualifications must be met, and endorsement by the religious group to which the applicant belongs is required. The American Association of Theological Schools recommends that preseminary studies be concentrated in the liberal arts. Although courses in English, philosophy, and history are considered especially important, the pretheological student also should take courses in the natural and social sciences, religion, and foreign languages. The standard curriculum recommended for accredited theological schools consists of four major fields: Biblical, historical, theological, and practical. There is a trend toward more courses in psychology, pastoral counseling, sociology, religious education, administration, and other studies of a practical nature. Many accredited schools require that students gain experience in church work under the supervision of a faculty member or experienced minister. Some institutions offer the master of theology and the doctor of theology degrees to students completing 1 year or more of additional study. Scholarships and loans are available for students of theological institutions.

In general, each large denomination has its own school or schools of theology that reflect its particular interests and needs; however, many of these schools are open to students from various denominations. Several interdenominational schools associated with universities give both undergraduate and graduate training covering a wide range of theological points of view.

Candidates for the ministry should be religious and dedicated; they should love and have the ability to work with people, and have high moral and ethical standards. Good health is a valuable asset.

Persons who have denominational qualifications for the ministry usually are ordained following graduation from a seminary. In denominations that do not require seminary training, clergymen are ordained at appointed times. Clergymen often begin their careers as pastors of small congregations or as assistant pastors in large churches. Protestant clergymen in many of the larger denominations—especially those groups that have a well-defined church organization—often are requested to serve in positions of great administrative and denominational responsibility.

Outlook

The shortage of Protestant ministers has abated significantly in recent years. The trend toward merger and unity among denominations, combined with the closing of smaller parishes, has reduced the demand for Protestant ministers who serve individual congregations. If this trend continues, new graduates of theological schools may face increasing competition in finding positions. The supply-demand situation will vary among denominations and depend, in part, on the length of formal preparation.

Although fewer opportunities may arise for Protestant ministers to serve individual congregations, ministers may find work among youth, in family relations, welfare, religious education, on the campus, and as chaplains in the Armed Forces, hospitals, universities, and correctional institutions. Most of the demand during the 1970's, however, will result from the need to replace those who retire, die, or leave the ministry.

Sources of Additional Information

Persons who are interested in the Protestant ministry should seek the counsel of a minister or church guidance worker. Additional information on the ministry and other church-related occupations also are available from many denominational offices. Information on admission requirements may be obtained directly from each theological school.

RABBIS

(D.O.T. 120.108)

Nature of the Work

Rabbis are the spiritual leaders of their congregations and teachers and interpreters of Jewish law and tradition. They conduct daily services, and deliver sermons at services on the Sabbath and on Jewish holidays. Rabbis customarily are available at all times to counsel members of their congregations, other followers of Judaism, and the community at large. Many of the rabbis' functions—preparing and delivering sermons, performing wedding ceremonies, visiting the sick, conducting funeral services, comforting the bereaved, helping the poor, counseling individuals, supervising religious education programs, engaging in interfaith activities, and assuming community responsibilities—are similar to those performed by clergymen of other faiths.

Rabbis serving large congregations may spend considerable time in administrative duties, working with their staffs and committees. Large congregations frequently have an associate or assistant rabbi in addition to the senior rabbi. Many of the assistant rabbis serve as Educational Directors.

Rabbis serve congregations affiliated with 1 of the 3 wings of Judaism—Orthodox, Conservative, or Reform. Regardless of their particular point of view, all Hebrew congregations preserve the substance of Jewish religious worship. The congregations differ in the extent to which they follow the traditional form of worship—for example, in the wearing of head coverings, the use of Hebrew as the language of prayer, or the use of music. The format of the worship service and, therefore, the ritual that the rabbis use may vary even among congregations belonging to the same wing of Judaism.

Rabbis also may write for religious and lay publications, and teach in theological seminaries, colleges, and universities.

Places of Employment

About 6,500 rabbis served almost 6.0 million followers of the Jewish faith in this country in 1970. Most are Orthodox rabbis; the rest are about equally divided between the Conservative and Reform wings of Judaism. Most rabbis act as spiritual leaders of individual congregations; some serve as chaplains in the Armed Forces, in hospitals, and in other institutions. Others are administrators or teachers in Jewish seminaries, communal schools, and other educational institutions or are employed in religious education work for organizations such as the Hillel Foundation. Still others are employed by Jewish social welfare agencies.

Although rabbis serve Jewish communities throughout the Nation, they are concentrated in those States that have large Jewish populations, particularly New York, California, Pennsylvania, New Jersey, Illinois, Massachusetts, Florida, Maryland, and the Washington, D.C. metropolitan area.

Training and Other Qualifications

To become eligible for ordination as a rabbi, a student must complete the prescribed course of study.

Entrance requirements and the curriculum depend upon the branch of Judaism with which the seminary is associated. About 15 seminaries train Orthodox rabbis in programs of varying lengths. Two of the larger seminaries require the completion of a 4-year college course for ordination. However, students who are not college graduates may spend a longer period at these seminaries and complete the requirements for the bachelor's degree while pursuing the rabbinic course. The other Orthodox seminaries do not require a college degree to qualify for ordination, although students who qualify usually have completed 4 years of college.

The Hebrew Union College—Jewish Institute of Religion is the official seminary that trains rabbis for the Reform branch of Judaism. The Jewish Theological Seminary of America is the official seminary that trains rabbis for the Conservative branch of Judaism. Both seminaries require the completion of a 4-year college course, as well as prior preparation in Jewish studies, for admission to the rabbinic program leading to ordination. Five years normally are required to complete the rabbinic course at the Reform seminary, including 1 year of preparatory study in Jerusalem. Exceptionally well-prepared students can shorten this period to a minimum of 3 years. A student having a strong background in Jewish studies can complete the course at the Conservative seminary in 4 years; for others, the course may take as long as 6 years.

In general, the curriculums of Jewish theological seminaries provide students with a comprehensive knowledge of the Bible, Talmud, Rabbinic literature, Jewish history, theology, and courses in education, pastoral psychology, and public speaking. The Reform seminary places less emphasis on the study of Talmud and Rabbinic literature and offers a broad course of study that includes subjects such as human relations and community organization.

Some seminaries grant advanced academic degrees in fields such as Biblical and Talmudic research. All Jewish theological seminaries make scholarships and loans available to students.

Newly ordained rabbis usually begin as leaders of small congregations, assistants to experienced rabbis, directors of Hillel Foundations, teachers in seminaries and other educational institutions, or chaplains in the Armed Forces. As a rule, the pulpits of large and well-established Jewish congregations are filled by experienced rabbis.

The choice of a career as a rabbi should be made on the basis of a fervent belief in the religious teachings and practices of Judaism, and a desire to serve the religious needs of others. In addition to having high moral and ethical values, the prospective rabbi should have good judgment and be able to write and speak effectively.

Outlook

In 1970, the number of rabbis in this country was inadequate to meet the expanding needs of Jewish congregations and other organizations desiring their services. This situation is likely to persist through the 1970's. Continued growth in Jewish religious affiliation and in the number of synagogues and temples, particularly in the suburbs of cities having large Jewish communities, together with increasing demands of large congregations for assistant rabbis, are expected to create many new openings. Demand for rabbis to work with social welfare and other organizations connected with the Jewish faith also is expected to increase. Although an increase in the number of students graduating from the Jewish theological seminaries is anticipated, the number of new rabbis probably will not be adequate to fill new openings and to replace the rabbis who retire or die, or leave the rabbinate for other reasons. Immigration, once an important source of rabbis, is no longer significant. In fact, graduates of American seminaries now are in demand for Jewish congregations in other countries.

Sources of Additional Information

Young people who are interested in entering the rabbinate should seek the guidance of a rabbi. Information on the work of a rabbi and allied occupations also is available from many of the local Boards of Rabbis in large communities. Information on admission requirements of Jewish theological seminaries may be obtained directly from each seminary.

ROMAN CATHOLIC PRIESTS

(D.O.T. 120.108)

Nature of the Work

Roman Catholic priests attend to the spiritual, moral, and educational needs of the members of their church. Their duties include offering the Sacrifice of the Mass; giving religious instructions in the form of a sermon; hearing confessions; administering the Sacraments, including the sacrament of marriage; visiting and comforting the sick; conducting funeral services and consoling relatives and friends; counseling those in need of guidance; and assisting the poor.

Priests spend long hours performing services for the church and the community. Their day usually begins with morning meditation and Mass and may end with the hearing of confessions or an evening visit to a hospital or a home. Many of them serve on church committees or in civic organizations and assist in community projects. Various societies that carry on charitable and social programs also depend upon priests for direction.

Although all priests have the same powers acquired through ordination by a bishop, they are classified in two main categories—diocesan and religious—by reason of their way of life, the type of work to which they are assigned, and the church authority to whom they are immediately subject. Diocesan priests (sometimes called secular priests) generally work as individuals in the parishes to which they are assigned by the bishop of their diocese. Religious priests generally work as members of a religious community in specialized activities, such as teaching or missionary work, assigned to them by the superiors of the religious order to which they belong; for example, Jesuits, Dominicans or Franciscans.

Both religious and diocesan priests hold teaching and administrative posts in Catholic seminaries, universities and colleges, and high schools. Priests attached to religious orders staff a large proportion of the institutions of higher education and many high schools, whereas, diocesan priests are concerned with the parochial schools attached to parish churches and with diocesan high schools. The members of religious orders do most of the missionary work conducted by the Catholic Church in this country and abroad.

Places of Employment

About 60,000 priests served more than 48 million Catholics in the United States in 1970. There are priests in nearly every city and town and in many rural communities; however, the majority are in metropolitan areas, where most Catholics reside. Catholics are concentrated in the Northeast and the Great Lakes regions, with smaller concentrations in California, Texas, and Louisiana. A large number of priests are located in communities near Catholic educational and other institutions. Others travel constantly on missions to local parishes throughout the country. Some priests serve as chaplains with the Armed Forces or in hospitals or other institutions. Many are stationed throughout the world as missionaries.

Training and Other Qualifications

Preparation for the priesthood requires 8 years or more of study beyond high school. More than 450 seminaries offer such education. Study may begin in the first year of high school, at the college level, or in theological seminaries after college graduation.

High school seminaries provide a college preparatory program that emphasizes English grammar, speech, literature, and social studies. Two years of Latin are required and the study of a modern language is encouraged. The seminary college offers a liberal arts program, stressing philosophy and religion; the study of man through the behavioral sciences and history; and the natural sciences and mathematics. In many college seminaries, a student may concentrate in any of these fields.

The remaining 4 years of preparation includes sacred scripture; apologetics (the branch of theology concerning the defense and proofs of Christianity); dogmatic, moral, and pastoral theology; homiletics; church history; liturgy (art of preaching); Mass; and canon law. Diocesan and religious priests attend different major seminaries, where slight variations in the training reflect the differences in the type of work expected of them as priests. During the later years of his seminary course, the candidate receives from his bishop a succession of orders culminating in his ordination to the priesthood.

Most postgraduate work in theology is given either at Catholic University of America, Washington, D.C. or at the eccelestical universities in Rome. Many priests also do graduate work at other universities in fields unrelated to theology. Priests are commanded by the law of the Catholic Church to continue their studies, at least informally, after ordination.

Young men are never denied entry into seminaries because of lack of funds. In seminaries for secular priests, the bishop may make arrangements for student loans. Those in religious seminaries often are financed by contributions of benefactors.

Among the qualities considered most desirable in candidates for the Catholic priesthood are a love of and concern for people, a deep religious conviction, a desire to spread the Gospel of Christ, the capacity to speak and write effectively, and the ability to work with people. Priests are not permitted to marry.

The first assignment of a newly ordained secular priest is usually that of assistant pastor or curate. Newly ordained priests of religious orders are assigned to the specialized duties for which they are trained. Many opportunities for greater responsibility exist within the hierarchy of the church. Diocesan priests, for example, may rise to positions such as monsignor or bishop. Much of their time at this level is given to administrative duties. In the religious orders which specialize in teaching, priests may become heads of departments or assume other positions which include administrative duties.

Outlook

A growing number of priests will be needed in the years ahead to provide for the spiritual, educational, and social needs of the growing number of Catholics in the Nation. Although the number of seminarians has increased steadily in recent years, the number of ordained priests is insufficient to fill the needs of newly established parishes and expanding colleges and other Catholic institutions, and to replace priests who retire or die. Although priests usually continue to work longer than persons in other professions, the varied demands and long hours create a need for young priests to assist the older ones. Also, an increasing number of priests have been serving in many diverse areas—in social work, religious radio, newspaper, and television work, labor-management mediation, and in foreign posts, particularly in countries that have a shortage of priests. Continued expansion of these activities, in addition to the expected further growth of the Catholic population, will require a steady increase in the number of priests through the 1970's.

Sources of Additional Information

Young men interested in entering the priesthood should seek the guidance and counsel of their parish priest. Additional information regarding different religious orders and the secular priesthood, as well as a list of the various seminaries which prepare students for the priesthood, may be obtained from Diocesan Directors of Vocations or from the diocesan chancery office.

CONSERVATION OCCUPATIONS

Forests, rangelands, wildlife, and water are part of our country's great natural resources. Conservationists protect, develop, and manage natural resources to assure that they are not needlessly exhausted, destroyed, or damaged, and that future needs for these resources will be met.

A young person seeking a career in conservation must have specialized training. An appropriate bachelor's degree generally is necessary for occupations such as forester and range manager. Short-term or on-the-job training generally is necessary for a semiprofessional position such as forestry aid.

In addition to technical knowledge and skills, the conservationist must have a sincere interest in nature and a desire to preserve it. He should be oriented toward public service because he is called upon to work increasingly with his community. A conservationist must be versatile to work at a remote camping area 1 week, speak before a community group the next, and fight a forest or brush fire the next.

This chapter describes three conservation occupations—forester, forestry aid, and range manager. Soil conservationist, a related occupation, is discussed elsewhere in the *Handbook*.

FORESTERS

(D.O.T. 040.081)

Nature of the Work

Forests are one of America's greatest natural resources. They cover about one-third of the land area of the country. Foresters manage, develop, and protect these valuable lands and their resources—timber, water, wildlife, forage, and recreation areas. They estimate the amount and value of these resources. They plan and supervise the harvesting and cutting of trees, purchase and sale of trees and timber, the processing, utilization and marketing of forest products, and reforestation, reseeding and replanting. Foresters also safeguard forests from fire, destructive animals and insects, and diseases. Other responsibilities of foresters include wildlife protection and watershed management, and the management of camps, parks, and grazing land.

Foresters usually specialize in one area of work, such as timber and wildlife management, outdoor recreation, and forest economics. Some of these specializations are becoming recognized as distinct professions. Range managers, for example, are discussed in a separate statement in this chapter. Foresters also may engage in research activities, extension work (providing forestry information to farmers, logging companies, and the public), forest marketing, and college and university teaching.

Places of Employment

An estimated 22,000 persons were employed as foresters in the United States in 1970. About one-third were employed in private industry, mainly by pulp and paper,

59

lumber, logging, and milling companies. More than one-fourth were employed by the Federal Government, mainly in the Forest Service of the Department of Agriculture. Other Federal agencies employing significant numbers of foresters were the Departments of the Interior and Defense. Most of the remainder were employed by State and local governments, colleges and universities, and consulting firms. Others were managers of their own lands or were in business for themselves as consultants.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in forestry is the minimum educational requirement for young persons seeking professional careers in forestry. An advanced degree is generally required for teaching and research positions.

Education in forestry leading to a bachelor's or higher degree was offered in 1970 by 52 colleges and universities of which 35 were accredited by the Society of American Foresters. The curriculums in most of these schools include specialized forestry courses in ten areas: (1) Dendrology (the characteristics, distribution, and occurrence of trees in forests); (2) forest ecology (structure and operation of the forest community); (3) silviculture (methods of growing and improving forest crops); (4) forest protection (primarily against fire, insects, and disease); (5) forest economics (economic and business principles and problems involved in the management and utilization of forest resources); (6) forest measurements (measuring and estimating present and potential resources); (7) forest policy (history and current status of Federal, State, and private policies relating to forests and other natural resources); (8) forest administration (principles of administration with special reference to problems faced by both public and private agencies); (9) forest resources management (study of the interrelations among the various forest resources and basic principles of forest land management); (10) forest resources use (principles underlying the uses of forest resources for human benefit). Some colleges require that students spend one summer in a field camp operated by the college. Students also are encouraged to work during summers in jobs that will give them firsthand experience in forest or conservation work.

Forestry graduates often work under the supervision of experienced foresters before advancing to responsible positions in management of forest lands or research.

Qualifications for success in forestry include an enthusiasm for outdoor work and the ability to meet and deal effectively with people. Many jobs also require physical stamina and a willingness to work in remote areas.

Employment Outlook

Requirements for foresters are expected to increase moderately through the 1970's. The number of new graduates, however, could more than meet anticipated demand if current trends continue. Therefore, new forestry graduates may face some competition for jobs. Factors underlying the anticipated demand for foresters are the country's growing population and rising living standards, which will tend to increase the demand for forest products and the use of forests for recreation. Employment also may be favorably influenced by the growing awareness of the need to conserve and replenish our forest resources, and to improve the quality of the environment.

Private owners of timberland are expected to employ increasing numbers of foresters to realize the higher profitability of improved forestry and logging practices. The forest products industries also will require additional foresters to apply new techniques for utilizing the entire forest crop, to develop methods of growing superior stands of trees over a shorter period of time, and to do research in genetics and fertilization. In addition, competition from metal, plastics, and other materials is expected to stimulate further research to develop new and improved wood products.

Employment opportunities for foresters in the Federal Government probably will not increase significantly through the 1970's because of the changing nature of the forester's duties. Specialized scientists —biologists, horticulturists, agronomists, chemists, etc., increasingly will be hired for the more scientific work previously performed by foresters.

Aids increasingly may perform many nonprofessional duties which could limit employment opportunities for foresters. Foresters, on the other hand, will be more concerned with the overall administration and coordination of the work of specialists and aids.

State Government agencies should continue to offer employment opportunities. Forest fire control, insect and disease protection, technical assistance to owners of forest lands and other Federal-State cooperative programs usually are channeled through State forestry organizations. Growing demands for recreation in forest lands may result in the expansion of State parks and other recreational areas.

College teaching and research in areas such as forest genetics and forest disease are other avenues of favorable employment opportunities for foresters, but primarily for those having graduate degrees.

In addition to new positions created by the rising demand for foresters, a few hundred openings will arise each year due to retirements, deaths, and transfers out of the professions.

Earnings and Working Conditions

In the Federal Government in 1970, beginning foresters having a bachelor's degree could start at either $6,548 or $8,098 a year, depending on their academic record. Those having 1 or 2 years of graduate work could begin at $8,098 or $9,881; those having the Ph. D. degree, at $11,905 or $14,192. District rangers employed by the Federal Government in 1970 generally earned between $9,881 and $14,192 a year. Foresters in top level positions earned considerably more.

Beginning salaries of foresters employed by State governments vary widely; but, with a few exceptions, they tend to be lower than Federal salaries. Entrance salaries in private industry, according to limited data, are fairly comparable to Federal salary levels.

The salaries of forestry teachers are generally the same as those paid other faculty members. (See statement on College and University Teachers.) Foresters in educational institutions sometimes supplement their regular salaries with income from part-time consulting and lecturing and the writing of books and articles.

As part of his regular duties, the forester—particularly in beginning positions—spends considerable time outdoors under all kinds of weather conditions. Many foresters work extra hours on emergency duty, such as fire-fighting.

Sources of Additional Information

General information about the profession of forestry, lists of reading material, as well as lists of schools offering training in forestry is available from:

Society of American Foresters, 1010 16th St., NW., Washington, D.C. 20036

General information also is available from:

American Forest Institute, 1835 K St. NW., Washington, D.C. 20006

A booklet entitled "So You Want to be a Forester" may be obtained from:

American Forestry Association, 919 17th St. NW., Washington, D.C. 20006

Information on forestry careers in the Forest Service is available from:

U.S. Department of Agriculture, Forest Service, Washington, D.C. 20250

FORESTRY AIDS

(D.O.T. 441.384)

Nature of the Work

Forestry aids, called forestry technicians at higher career levels, assist foresters in managing and caring for forest lands and their resources. (See statement on Foresters earlier in this chapter.) Their duties include scaling logs, marking trees, and collecting and recording data such as tree heights, diameters, and mortality. On simple watershed improvement projects, aids install, maintain, and collect records from rain gauges, streamflow recorders, and soil moisture measuring instruments. They may serve as rodmen, chainmen, or level instrumentmen on road survey crews.

Forestry aid uses tree injector to get herbicide into tree.

Forestry aids prevent and control fires. They instruct persons using the forest and lead fire-fighting crews if a fire does occur. After suppressing the fire, they take inventory of burned areas, and plant new trees and shrubs.

Forestry technicians supervise timber sales, recreation-area use, and road-building crews that make timber accessible for cutting.

Places of Employment

An estimated 11,100 persons were employed as forestry aids in 1970. Almost 5,500 were employed by the Federal Government; the Forest Service of the U.S. Department of Agriculture employed approximately 3,200 of these. Approximately 1,700 were working for State governments. About 3,800 were employed in private industry, primarily by lumber, logging, and paper milling companies. Forestry aids also work in tree nurseries and in forestation projects of mining, railroad, and oil companies.

Many forestry aids are employed in the heavily forested States of Washington, California, Oregon, Idaho, Utah, and Montana, as well as in the forested areas of the Great Lakes States, the Northeast, and the South.

Training, Other Qualifications, and Advancement

Young persons qualify for beginning positions through work experience, a government sponsored training program, or by completing a specialized 1- or 2-year post secondary school curriculum. In 1970, about 50 technical institutes, junior or community colleges, and ranger schools offered curriculums training forestry aids.

Among the specialized courses are forest mensuration (measurement of the number and size of trees and shrubs), wood utilization, and silviculture (methods of growing and improving forest crops). In addition, students take courses in drafting, surveying, report writing, and first aid. They also may live in a forest or camp operated by the school to gain experience.

Young people also may obtain the necessary training in programs sponsored under the Manpower Development and Training Act which are presently available in Arkansas, Colorado, Michigan, and Washington.

Persons who have not had specific training usually must have experience in forest work, such as planting trees or fighting fires, to qualify for beginning forestry aid jobs. The Federal Government requires a minimum of two seasons of related work experience. Those who have had technical experience, such as estimating timber resources, may qualify for more responsible positions.

Essential for success in this field are an enthusiasm for outdoor work, physical stamina, and the ability to carry out tasks without direct supervision. The forestry aid also should be able to work well with survey crews, users of the forestlands, forest owners, and professional foresters. Many jobs also require a willingness to work in remote areas.

Employment Outlook

Employment opportunities for forestry aids are expected to increase rapidly through the 1970's. Prospects will be especially good for those having post-high-school training in a forestry curriculum. As the employment of foresters continues to grow, increasing numbers of forestry aids will be needed to assist them. Also, it is expected that forestry aids will assume some of the more routine jobs now being done by foresters.

Private industry is expected to provide many additional employment opportunities for forestry aids. Forest products industries are becoming increasingly aware of the profitability of employing technical persons knowledgeable in the practical application of scientific forest practices.

The Federal Government also is likely to offer increasing employment opportunities through the 1970's, mainly in the Forest Service of the Department of Agriculture. Similarly, State governments probably will increase their employment of forestry aids. Growth in Government employment will stem from factors such as increasing demand for recreational facilities and the trend toward more scientific management of forest land and water supplies.

Earnings and Working Conditions

Annual earnings of forestry aids range from about $4,500 to almost $10,000 a year; those having high earnings usually have had many years of experience. In the Federal Government, beginning forestry aids and technicians earned between $4,621 and $6,548 a year in 1970, depending on the applicant's education and experience. Beginning salaries in private industry were similar, according to limited data.

As part of their regular duties, forestry aids must spend considerable time outdoors during all weather conditions. In emergencies, such as firefighting and flood control, forestry aids work many extra hours. In addition to those employed full time, many forestry aids are hired on a seasonal basis and work 3 to 6 months a year. Climatic conditions in some areas limit year-round field work and some jobs, such as firefighting, are seasonal in nature.

Sources of Additional Information

Information about a career in the Federal Government as a forestry aid is available from:

U.S. Department of Agriculture,
Forest Service, Washington, D.C.
20250.

For a list of schools offering training in the field, write to:

Society of American Foresters, 1010
16th Street, NW., Washington,
D.C. 20036.

RANGE MANAGERS

(D.O.T. 040.081)

Nature of the Work

Rangelands cover more than 1 billion acres in the United States, mostly in the Southern and Western States, including Alaska. They contain many natural resources including grass and shrub forage; habitats for livestock and wildlife; facilities for water recreation; and environmental areas for scientific research. Range managers, also called *range conservationists* or *range scientists,* manage, develop, and protect these rangelands and their resources. They establish grazing plans that will yield a high production of livestock while preserving soil and vegtation for other land use requirements—wildlife grazing, recreation, growing timber, and watersheds. Range managers evaluate forage resources; decide on the number and appropriate type of livestock to be grazed and the best season for grazing; restore deteriorated rangelands through seeding or plant control; and determine other range conservation and development needs. Range fire protection, pest control, and grazing trespass control also are important activities of this occupation. Because of the multiple use of rangelands, the manager's work often extends into closely related fields such as wildlife and watershed management, land classification, forest management, and recreation.

The range manager may also teach, write reports, conduct research in range maintenance and improvement, and provide technical assistance to holders of privately owned grazing lands and to foreign countries.

Places of Employment

In 1970, an estimated 3,600 professional range managers were employed in the United States. The majority were employed by Federal, State, and local government agencies. In the Federal Government, most worked in the Forest Service and the Soil Conservation Service of the Department of Agriculture and in the Bureau of Land Management of the Department of the Interior.

Some range managers are employed by privately owned range livestock ranches and consulting firms. Some manage their own land. A few are self-employed consultants. Others are employed by manufacturing, sales, and service enterprises, and by banks and real estate firms which need rangeland appraisals. Colleges and universities also employ range managers in teaching and research positions.

Range manager checks enclosure used for grass growing experiment.

Training, Other Qualifications, and Advancement

The bachelor's degree with a major in range management or range conservation is the usual requirement for persons seeking employment as range managers in the Federal Government. A bachelor's degree in a closely related field, such as agronomy or forestry, including courses in range management and range conservation, also is accepted. Graduate degrees are generally required for teaching and research.

Training leading to a bachelor's degree specifically in range management or range science was offered in 1970 by 14 colleges and universities; 13 additional schools had programs in related fields such as forestry, botany, or agronomy, with an option or major in range management. Fourteen schools offered master's degrees in range management or range science—five in agriculture, forestry, or botany with a major in range management, and 12 schools offered the Ph. D. in range science or a related field with a range major.

The essential courses for a degree in range management are botany, plant ecology, and plant physiology; zoology; animal husbandry; soils; chemistry; mathematics; and specialized courses in range management. Desirable electives include economics, statistics, physics, geology, and watershed, and wildlife management.

Federal Government agencies—primarily the Forest Service, the Bureau of Land Management and the Soil Conservation Service—hire some college juniors and seniors for summer jobs in range management. This experience helps students qualify for permanent positions as range managers when they complete college.

Because most range managers must meet and deal with other people, individually or in groups, they should be able to communicate their ideas effectively, both in writing and speaking. Many jobs require the stamina to perform vigorous physical activity and a willingness to work in arid and sparsely populated areas.

Employment Outlook

Employment opportunities for range managers primarily will result from the need to replace experienced range managers who die, retire, or transfer to other occupations. Employment opportunities in the Federal Government probably will decrease because of the changing nature of the range manager's duties; he will assume more administrative and managerial duties. The scientific and technical duties once performed by range managers increasingly will be performed by natural scientists. The declining employment opportunities in the Federal Government will be offset somewhat by increasing employment opportunities in the private sector.

Favorable job opportunities are anticipated in private industry, since range livestock producers and private timber operators probably will hire increasing numbers of range managers. A few openings are expected in developing countries of the Middle East, Africa, and South America.

Major factors underlying the increasing demand for range managers are population growth, increasing per capita consumption of animal products, and the growing use of rangelands for hunting and other recreation.

Earnings and Working Conditions

In the Federal Government, starting salaries for range managers having the bachelor's degree were dependent upon the applicant's college record and ranged from $6,548 to $8,098 in 1970. Beginning salaries of those having 1 or 2 years of graduate work were $8,098 or $9,881; and for those having the Ph. D. $11,905 to $14,192.

Starting salaries for range managers employed by State governments and private industry in 1970 were about the same as those paid by the Federal Government. In colleges and universities, starting salaries were generally the same as those paid other faculty members. (See statement on College and University Teachers.) Range managers in educational institutions sometimes augment their regular salaries with income from part-time consulting and lecturing and from writing books and articles.

Range managers may spend considerable time away from home working outdoors in remote parts of the range.

Sources of Additional Information

For general information about a career as a range manager as well as a list of schools offering training in the field, write to:

Society for Range Management,
2120 South Birch Street, Denver,
Colo. 80222.

Information about career opportunities in the Federal Government may be obtained from:

Bureau of Land Management, Denver Service Center, Federal Center

Building 50, Denver, Colorado 80225.

or

Portland Service Center, 710 NE. Holladay Street, Portland, Oregon 97208.

Forest Service, U. S. Department of Agriculture, 1621 North Kent Street, Arlington, Virginia 20415.

Soil Conservation Service, U. S. Department of Agriculture, Washington, D. C. 20250.

COUNSELING OCCUPATIONS

The primary objectives of professional counseling are to help persons understand themselves and their opportunities better so that they can make and carry out decisions and plans that hold potential for a satisfying and productive life. Whatever the area of counseling—personal, educational, or vocational—counselors need a concern for individuals combined with a capacity for objectivity; and a belief in the worthwhileness and uniqueness of each individual, in his right to make and accept responsibility for his own decisions, and in his potential for development.

This chapter deals, in detail, with three generally recognized specialties in the field: School counseling, rehabilitation counseling, and employment counseling.

School Counselors are the largest counseling group. They are concerned with the personal and social development of pupils and the planning and achievement of their educational and vocational goals.

Rehabilitation Counselors work with persons who are physically, mentally, or socially handicapped. Their counseling is vocationally oriented but involves personal counseling as well.

Employment Counselors are concerned primarily with career planning and job adjustment. They may work with the young, the old, the able-bodied, and the disabled.

Young persons considering counseling careers should have an interest in helping people. The ability to understand the behavior of people is important to counselors who sometimes must do a great deal of research into the individual's background. Counselors should have the type of pleasant and strong personality that instills confidence in their clients. Sensitivity to the needs of people, patience, and an ability to communicate orally as well as in writing are important, also.

Some persons working in other professional occupations provide counseling services, as well. The occupation most closely related to counselor is counseling psychologist. Many social workers also provide counseling services. These two occupations, as well as others in which workers do some counseling but primarily work in teaching, health, law, religion, or other fields, are described elsewhere in the *Handbook*. For information on counseling services provided by college and university staff members and by personnel workers in government and industry, see the statements on "College Placement Officers" and "Personnel Workers."

EMPLOYMENT COUNSELORS

(D.O.T. 045.108)

Nature of the Work

Employment counselors (sometimes called vocational counselors) help individuals seeking aid to develop a career goal that will fulfill their potential and bring personal satisfaction. They assist clients by planning with them how to prepare for and enter careers, and how to make progress in them.

The extent of the counseling assistance available differs among agencies rendering the service. Sometimes their clients are skilled in specific occupations, and ready for immediate job placement. Sometimes they need intensive training to prepare them for jobs. The counselor may help them find appropriate training.

Counselors interview clients to obtain vocationally significant information related to their personal traits, interests, training, work experience, and work attitudes. They may assist individuals in filling out questionnaires concerning their personal history and background. Additional data on a person's general intelligence, aptitudes and abilities, physical capacities, knowledge, skills, interests, and values also are obtained from tests and personal inventories which may be administered or recorded by the counselor or a specialist in testing. Further information may be assembled by the counselor or the client from sources such as former employers, schools, and health or other agencies.

Counselors assist clients in evaluating and understanding their work potential, and provide them with information that they need in making plans appropriate to their talents and interests. Job requirements and employment opportunities or training programs are discussed. In some agencies, a vocational plan, or employability plan, is developed jointly by the counselor and his client and may specify a series of steps involving remedial education, vocational training, work experience, or other services needed to enhance his employability. Often in developing this plan, the employment counselor works with a team of specialists.

In many cases, employment counselors refer clients to other agencies for physical rehabilitation or for psychological or other services before, or concurrent with, counseling. Employment counselors must be familiar with the services available in the community. They

should be able to recognize what services might be beneficial to a particular client.

Counselors may help clients by suggesting feasible employment sources and appropriate ways of applying for work. In instances where a client needs further support and assistance, counselors may contact employers, although clients seeking employment usually are sent to placement interviewers after counseling. After job placement or entrance into training, counselors may follow up to determine if additional assistance is needed. The expanding responsibility of public employment service counselors for improving the employability of disadvantaged persons has increased their contacts with these persons during training and on the job. It also has led to group counseling and the stationing of counselors in neighborhood and community centers.

Places of Employment

In 1970, the largest number of employment counselors—about 6,000—worked in State employment service offices, located in every large city and in many smaller towns. The next largest number—probably about 2,000—worked for various private or community agencies, primarily in the larger cities. In addition, some worked in institutions such as prisons, training schools for delinquent youths, and mental hospitals. The Federal Government employed a limited number of employment counselors, chiefly in the Bureau of Indian Affairs and the Veterans Administration. Some people trained in employment or vocational counseling are engaged in research or graduate teaching. About half of all employment counselors are women.

Training, Other Qualifications, and Advancement

The generally accepted minimum educational requirement for employment counselors in State employment service offices is a bachelor's degree, preferably with a major in one of the social sciences, plus 15 semester hours in counseling and related courses. Most States have adopted a three-level counselor classification system which includes a *counselor trainee,* requiring a bachelor's degree with 15 hours of undergraduate or graduate work in counseling related courses; a *counselor,* requiring a master's degree or 30 graduate hours in counseling related courses; and a *master counselor*, requiring a master's degree and 3 years of experience, 1 of which should be in employment service counseling.

Although minimum entrance requirements are not standardized among private and community agencies, most of them prefer, and many require, a master's degree in vocational counseling or in a related field such as psychology, personnel administration, education, or public administration. Many private agencies prefer to have at least one staff member who has a doctorate in counseling psychology or a related field. For those lacking an advanced degree, employers usually emphasize experience in closely related work such as rehabilitation counseling, employment interviewing, school or college counseling, or teaching.

The public employment service offices in each State provide in-service training programs for their new counselors or trainees. Their experienced counselors frequently are given additional training at colleges and universities, often leading to a master's degree in counseling and guidance. Private and community agencies also often provide in-service training opportunities.

The professional educational curriculum for employment counselors generally includes, at the undergraduate level, a basic foundation in psychology with some emphasis on sociology. At the graduate level, requirements usually include courses in techniques of appraisal and counseling for vocational adjustment, group methods, counseling followup techniques, psychological testing in vocational counseling, educational psychology, psychology of occupations, industrial psychology, job analysis and theories of occupational choice, administration of guidance services, and some course work in research methods and statistics.

Counselor education programs at the graduate level are available in about 370 colleges and universities, most frequently in the departments of education or psychology. To obtain a master's degree, students must complete 1 to 2 years of graduate study. All States require counselors in their public employment offices to meet State civil service or merit system requirements that include certain minimum educational and experience standards. They also require a written or oral examination, or both.

Counselors who are well qualified may advance, after experience, to supervisory or administrative positions in their own or other organizations; some may become directors of agencies or of other counseling services, or area supervisors of guidance programs; some may become consultants; and others, may become professors in the counseling field.

Employment Outlook

Employment counselors who have a master's degree, and others with recognized related experience in the field, will have very good employment opportunities in both public and community agencies through the 1970's. In addition, college graduates having a bachelor's degree and 15 hours of undergraduate or graduate work in counseling-related courses will find many opportunities in State and local employment service offices as counselor trainees.

Employment of counselors in State employment service offices is expected to increase very rapidly through the 1970's. The role of employment counselors has become increasingly important as new programs have been developed to deal with unemployment among the unskilled, minorities, and displaced persons in a complex urban labor market. Many of these programs, beginning with the Manpower Development and Training Act of 1962, deal with training and retraining of these workers for fuller utilization of their potentials. The stimulus for most of these programs was public awareness, concern, and recognition that additional services would have to be provided if individuals with limited skills were to find satisfactory employment. As a result, the emphasis of employment counseling in State employment service offices has shifted from helping unemployed persons to seek and obtain employment to providing multifaceted assistance to help both unemployed and underemployed persons obtain suitable jobs.

In addition to the counselors needed because of growth in the occupation, many will be needed each year through the 1970's to replace workers who retire, die, or leave the profession for other reasons.

Earnings and Working Conditions

Salaries of employment counselors in State employment services vary considerably from State to State. In 1970, minimum annual salaries ranged from about $6,100 to $11,600, with a mean of $7,700. Maximum salaries ranged from $7,700 to nearly $14,000, with a mean of about $9,900. More than one-third of the States listed maximum salaries of $10,000 or over. Trainees for counseling positions in some voluntary agencies in large cities were being hired at about $6,500 a year; annual salaries reported for experienced counselors ranged up to $15,000 or more in 1970.

Most counselors work about 40 hours a week and have various benefits, including vacations, sick leave, pension plans, and insurance coverage. Counselors employed in community agencies may work overtime.

Sources of Additional Information

General information on employment or vocational counseling may be obtained from:

National Employment Counselors Association, 1607 New Hampshire Ave., NW., Washington, D.C. 20009.

National Vocational Guidance Association, Inc., 1607 New Hampshire

Ave., NW., Washington, D.C. 20009.

Specific information regarding local job opportunities, salaries, and entrance requirements for positions in public employment service offices may be obtained from the administrative office of the particular State employment security agency, bureau, division, or commission, which operates the service in the State in which interested. Such offices are usually in the State capital.

REHABILITATION COUNSELORS

(D.O.T. 045.108)

Nature of the Work

Rehabilitation counselors are concerned primarily with the vocational and personal adjustment of persons handicapped in various ways, either physicially, mentally, or socially. First, the counselor interviews the handicapped person to learn his abilities, interests, and limitations. Then, using such information along with other medical, psychological, and social data available, he helps the handicapped person evaluate himself—his physical and mental capacity, interests, and talents—in terms of work suited to these needs and abilities.

At this point, the counselor may work out a plan of rehabilitation with the handicapped person, along with other specialists responsible for the latter's medical care and occupational training and for other services needed to carry out the program. As this plan is put into effect, the counselor meets regularly with the disabled person to discuss the program, check on progress made, and help resolve problems. When the person is ready for employment, the counselor helps him find a suitable job, and often makes followup checks to be sure that the placement is satisfactory.

An increasing number of counselors specialize in a particular area of rehabilitation; for example, some work almost exclusively with the blind, some with alcoholics, and others with the mentally ill or retarded. Still others work with the disabled in poverty areas.

The time spent in the direct counseling of each individual varies with the person and the nature of his disability, as well as with the counselor's workload. Some rehabilitation counselors are responsible for many persons in various stages of rehabilitation; on the other hand, less experienced counselors, or specialized ones working with the severely handicapped may handle relatively few cases at a time. In ad-

dition to working with the handicapped person, the counselor also must maintain close contact with other professionals who work with handicapped persons, members of their families, other agencies and civic groups, and private employers who hire the handicapped. The counselor often is responsible for related activities, such as employer education and community publicity for the rehabilitation program.

Places of Employment

About 13,000 rehabilitation counselors were employed in 1970; more than 11,000 were full-time counselors. About three-fourths of all rehabilitation counselors were employed in State and local rehabilitation agencies financed cooperatively with Federal and State funds. The remainder were employed by hospitals, labor unions, insurance companies, special schools, rehabilitation centers, sheltered workshops, and other public and private agencies that conducted rehabilitation programs and provided job placement services for the disabled. In addition, about 400 counseling psychologists in the Veterans Administration provided rehabilitation counseling.

An estimated 30 percent of all rehabilitation counselors are women.

Training, Other Qualifications, and Advancement

The basic educational requirement for entry into this occupation is a bachelor's degree with course credits in counseling, psychology, and related fields. However, employers are placing increasing emphasis on the master's degree in vocational or rehabilitation counseling or in a related discipline such as psychology, education, or social work. Work experience in related fields, such as vocational counseling and placement, social work, psychology, education, and other types of counseling, is given considerable weight by some employers, especially when considering applicants who have only the bachelor's degree. Some agencies assist employees having bachelor's degrees to attain graduate degrees through work-study programs.

Usually, 2 years are required to qualify for the master's degree in the fields of study preferred for rehabilitation counseling. The curriculum for the master's degree may include a basic foundation in psychology and specified courses in other fields. The latter may include counseling theories and techniques, occupational and educational information, community resources, placement and follow-up, tests and measurements, the cultural and psychological effects of disability, and the medical and legislative aspects of therapy and rehabilitation.

To earn the doctorate in rehabilitation counseling or in counseling psychology may require a total of 4 to 6 years of graduate study. Intensive training in psychology, other social sciences, as well as research methods, is required.

In 1970, 70 colleges and universities offered financial assistance to a limited number of full-time graduate students specializing in rehabilitation counseling through training grants provided by the Rehabilitation Services Administration of the U.S. Department of Health, Education, and Welfare.

To qualify for work with a number of the State Rehabilitation Agencies applicants must comply with State civil service and merit system rules. In most cases, these regulations require applicants to pass a written competitive examination, sometimes supplemented by an individual interview and evaluation by a board of examiners. A few States require counselors to be residents of the State in which they work.

Counselors having limited experience usually are assigned the least difficult cases. As they gain experience, cases representing more difficult rehabilitation problems are assigned to them. After obtaining considerable experience, rehabilitation counselors may be advanced to supervisory positions or to top administrative jobs.

Employment Outlook

Employment opportunities for rehabilitation counselors are expected to be very good through the 1970's. In addition to openings expected to be created by the very rapid growth of the profession, several hundred counselors will be needed annually to replace those who die, retire, or leave the field for other reasons. Persons who have graduate work in rehabilitation counseling or in related fields have the best employment prospects.

The number of counselors currently being trained is below the number of new entrants that are expected to be needed during the early 1970's. During this period, therefore, opportunities in rehabilitation counseling will be favorable for persons with experience in related fields such as psychology, social work, and education.

Among the factors contributing substantially to long-run demand for the services of rehabilitation counselors will be population growth, with related increases in numbers to be served, along with extension of vocational rehabilitation to greater numbers of the severely disabled. An additional stimulus should be the increasing support for the service in general including a growing recognition that the vocational rehabilitation approach helps the disadvantaged achieve self-support.

Earnings and Working Conditions

According to the U.S. Department of Health, Education, and Welfare, the median salaries of rehabilitation counselors employed in State agencies generally ranged from $7,800 to $10,000 a year in 1970. Counselors working with the disabled in the Veterans Administration were hired in 1970 at $13,493 or $14,665, depending upon education and experience. A small number of counselor trainees were hired at annual salaries of $9,881. For positions in VA hospitals requiring the doctorate, salaries ranged generally from $13,493 to $16,790, depending on the applicant's experience and other qualifications. The average salary for doctorate degree holders was $18,900.

Counselors may spend only part of their time counseling in their offices, and the remainder in the field, working with prospective employers, training agencies, and the disabled person's family. The ability to drive a car is often necessary for field work.

Rehabilitation counselors generally work a 40-hour week or less, with little overtime work required; however, they often must attend community and civic meetings in the evenings. They usually are covered by sick and annual leave benefits, and pension and health plans.

Sources of Additional Information

Additional information on rehabilitation counseling as a career may be obtained from:

American Psychological Association, Inc., 1200 17th St. NW., Washington, D.C. 20036.

American Rehabilitation Counseling Association, 1607 New Hampshire Ave. NW., Washington, D.C. 20009.

National Rehabilitation Counseling Association, 1522 K St. NW., Washington, D.C. 20005.

A list of colleges and universities that have received grants to provide rehabilitation traineeships on a graduate level is available from:

U.S. Department of Health, Education, and Welfare, Rehabilitation Services Administration, Washingtion, D.C. 20201.

SCHOOL COUNSELORS

(D.O.T. 045.108)

School counselors are concerned with the educational, vocational, and social development of students. In carrying out their responsibilities, counselors work with students, both individually and in groups, as well as with teachers, other school personnel, parents, and community agencies.

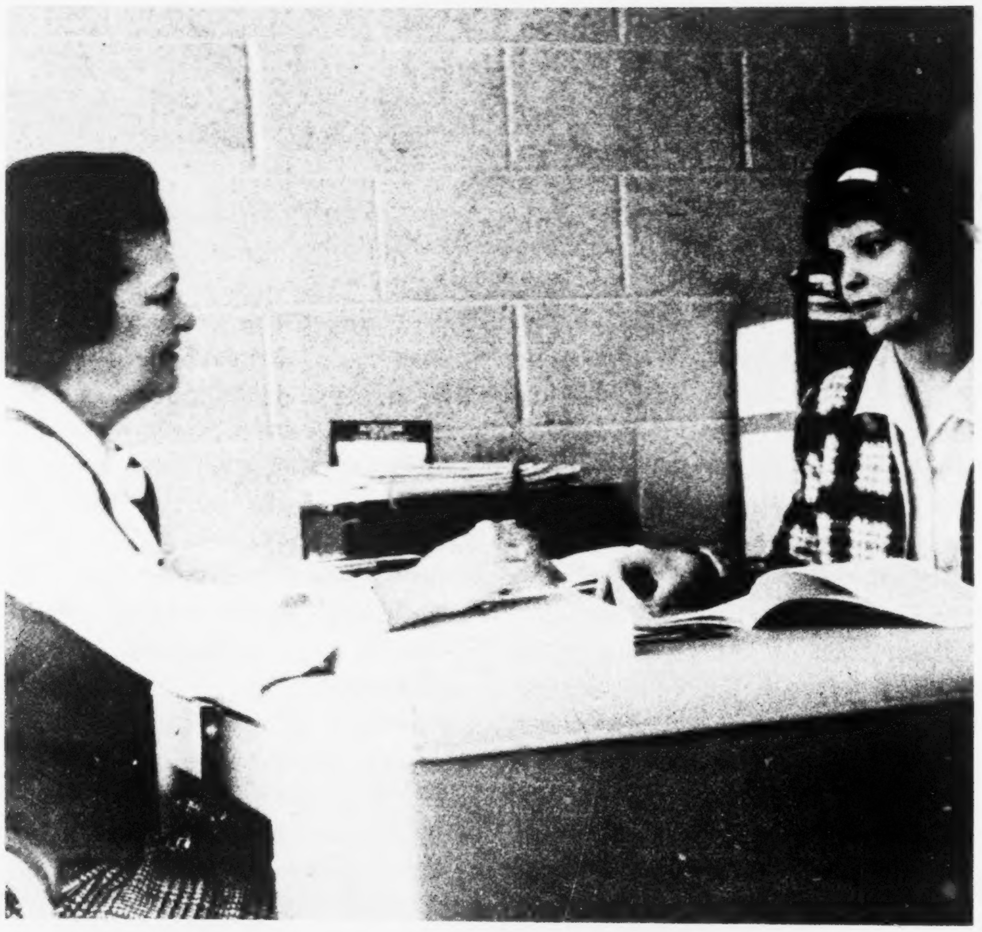
In the process of helping students find their interests and abilities to use in their educational and vocational planning, counselors in secondary schools obtain information from a variety of sources. These include talking with students, referring to their school and other records, and using tests to help assess a student's chances of success in given studies or occupations. The counselor then helps the student analyze and interpret the results, and develops with him—and sometimes with his parents, as well—a course of study and an educational plan fitting his abilities, interests, and vocational opportunities.

To acquaint a student with the nature of the work in which he has shown an interest, the counselor may provide descriptions of work, training requirements, earnings, and outlook. He may maintain files or libraries of occupational literature for both students and their parents to use. To provide a view of real work settings, he may arrange trips to factories and business firms, and show vocational films. To bring the work-place into the school, the counselor may conduct "career day" programs.

He also counsels the student about opportunities for educational and vocational training beyond high school, including those in 2- and 4-year colleges; in trade, technical and business schools; in apprenticeship programs, and in programs under the Manpower Development and Training Act of 1962.

Counselors in secondary schools may also help students find part-time work while in school, either to enable them to stay in school or to help them prepare for their vocation. Counselors may also assist students, on leaving school, in locating full-time employment themselves or in using community employment services. Some counselors also take part in studies to follow up on recent graduates and dropouts, to survey local job opportunities, or to determine the effectiveness of the educational and guidance programs.

Many secondary school counselors, in addition, help students individually with personal and social problems common to adolescence. Counselors also lead discussion



groups on topics related to student interests and problems.

Elementary school counselors help children to make the best use of their abilities by identifying these and other basic aspects of their makeup, at an early age, and by evaluating any learning problems. Methods used in counseling grade school children necessarily differ in many ways from those used with older students. Observations of classroom and play activity furnish clues about children in the lower grades. To better understand the children, elementary school counselors spend much of their time consulting with teachers and parents. They also work closely with other staff members of the school, including psychologists and social workers.

Some school counselors, particularly in secondary schools, may teach classes in occupational information, social studies, or other subjects in addition to counseling. They also may supervise school clubs or other extracurricular activities, often after regular school hours.

Places of Employment

An estimated 54,000 school counselors were employed full-time during the 1970–71 school year. More than four-fifths worked in public secondary schools. About 10 percent were employed in public elementary schools where counseling services are being steadily expanded. The others were employed in junior colleges, technical institutes, and private elementary and secondary schools.

The majority of counselors work in large schools. An increasing number of school districts, however, are providing guidance services to their small schools by assigning more than one school to a counselor.

Training, Other Qualifications, and Advancement

Most States require counselors to have both a counseling and a teaching certificate. (See statement on Elementary and Secondary School Teachers for teaching certificate requirements.) A counseling certificate requires graduate level work and usually from 1 to 5 years of teaching experience. A person planning to counsel should learn the specific requirements of the State in which he plans to work, since such requirements vary considerably among the States and also are changing rapidly.

Undergraduate college students interested in becoming school counselors usually enroll in the regular program of teacher education, preferably taking additional courses in psychology and sociology. In States where teaching experience is not a requirement it is possible to major in a liberal arts program. After graduating from college, they may gain the experience required, teaching or other, before or during graduate study. A few States substitute counseling internship for teaching experience. In some States, teachers who have completed part of the courses required for the master's degree are eligible for provisional certification and may work as counselors under supervision while taking additional courses.

The subject areas of the required graduate-level courses usually include appraisal of the individual student, counseling procedures for group guidance, use of information services for vocational development, development and management of overall program, professional relations and ethics, and statistics and research. Supervised field experience or internship is provided in an increasing number of programs. Counselor education programs at the graduate level are available in more than 370 colleges and universities, most frequently in the departments of education or psychology. To obtain a master's degree, a student must complete 1 to 2 years of graduate study. School counselors may advance to counselor supervisors or directors of pupil personnel services or to other administrative positions within the school system.

Employment Outlook

Employment opportunities for well-trained school counselors are expected to be good through the 1970's. Job openings for counselors are expected to increase rapidly due to continued strengthening of counseling services in elementary and secondary schools. The average ratio of counselors to students as a whole is still well below generally accepted standards, despite the financial aid which the Federal Government has provided to States for school counseling programs under the National Defense Education Act of 1958, as amended, and other legislation.

In addition to the number of counselors needed to take care of the anticipated expansion of the occupation, many counselors also will be required, each year to replace those leaving the profession.

Among the factors affecting the employment growth of school counselors is the increasing recognition of counseling as an essential educational service for all pupils—the average, the gifted, the slow, the disadvantaged, and the handicapped. Moreover, Federal legislation such as the Elementary and Secondary Education Act amendments of 1966, the National Defense Education amendments of 1966, and the Vocational Education amendments of 1968 has extended support of school counseling services to elementary schools, vocational and technical schools, and junior colleges.

Also contributing to the increased demand for counseling services is the growing public awareness of the value of guidance services in helping students with personal and social problems. This in turn, may help reduce the number of school dropouts. Students will also be seeking advice from school counselors about educational requirements for concerns such as entrance-level jobs, job changes caused by automation and other technological advances, college entrance requirements, and places of employment.

Earnings and Working Conditions

According to the National Education Association, the average annual salaries during the 1969–70 school year for school counselors having the bachelor's degree ranged from $7,300 to $10,300, and for those having the master's, from $8,300 to $12,400. School counselors having the doctorate earned as much as $18,700. Many school counselors had annual earnings higher than those of classroom teachers with comparable educational preparation and experience. (See statements on Kindergarten and Elementary School Teachers and Secondary School Teachers.)

In most school systems, counselors receive regular salary increments as their counseling experience increases, and as they obtain additional education. Some counselors supplement their income by part-time consulting or other work with private or public counseling centers, government agencies, or private industry.

Sources of Additional Information

Information on colleges and universities offering training in guidance and counseling, as well as on the certification requirements of each State, may be obtained from the State department of education at the State capital.

Additional information on this field of work may be obtained from:

American School Counselor Association, 1607 New Hampshire Ave. NW., Washington, D.C. 20009.

ENGINEERS

Engineers contribute in countless ways to the welfare, technological progress, and defense of the Nation. They develop complex electric power, water supply, and waste disposal systems to meet the problems of urban living. They design industrial machinery and equipment needed to manufacture goods on a mass production basis, and heating, air conditioning, and ventilation equipment for the comfort of man. Also, they develop scientific equipment to help probe the mysteries of outer space and the depths of the ocean, and design and supervise the construction of highways and rapid transit systems for safe and more convenient transportation. In addition, they design and develop consumer products such as automobiles and refrigerators. They also provide the raw materials that make all this possible.

This chapter contains an over-all discussion of engineering, followed by separate statements on several branches of the field—aerospace, agricultural, biomedical, ceramic, chemical, civil, electrical, industrial, mechanical, metallurgical, and mining engineering. Although most engineers specialize in these or other specific branches of the profession, a considerable body of basic knowledge and methodology is common to most areas of engineering. Also, unified curriculums in engineering (without specialty designation) and in engineering science are increasing in popularity. Therefore, young people considering engineering as a career should become familiar with the general nature of engineering as well as with its various branches.

Nature of the Work

Engineers develop methods for converting the raw materials and sources of power found in nature into useful products at a reasonable cost in terms of time and money. They use basic scientific principles to solve the problems involved in designing goods and services and developing methods for their production. The emphasis on the application of scientific principles, rather than on their discovery, is the main factor that distinguishes the work of the engineer from that of the scientist. For example, a physicist may discover that the properties of a gas change when it is converted into a liquid at extremely low temperatures, but the engineer develops uses for the liquid, or economical methods for its production.

In designing or developing a new product, engineers must consider many factors. For example, in designing a space capsule, they must calculate how much heat, radiation, air pressure, and other forces the capsule must withstand during its flight to insure the safety of the occupants and prevent the malfunctioning of its instrumentation. Experiments must be conducted which relate these factors to various construction materials, as well as to the many possible capsule sizes, shapes, and weights. Equally important are the human needs and limitations of the people who must operate the equipment. In addition, the engineer must take into account the relative cost of the required materials and the cost and time of the fabrication process. Similar factors must be considered by engineers who design and develop a wide variety of products ranging from transistor radios and washing machines to electronic computers and industrial machinery.

Besides design and development, engineers engage in many other activities. Many work in inspection, quality control, and other activities related to production in manufacturing industries, mines, and agriculture. Others are administrators and managers whose knowledge of engineering is important. A large number plan and supervise the construction of buildings and highways. Many are employed in sales positions, where they must discuss the technical aspects of a product or assist in planning its installation or use. (See statement on Manufacturers' Salesmen.) Some conduct research aimed at supplying the basic technological data needed for the design and production of new or improved products. Some engineers having considerable experience work as consultants. A relatively small group, especially at the Ph. D. level, teach in the engineering schools of colleges and universities.

Most engineers specialize in one of the many branches of the profession. More than 25 engineering specialties are recognized by the profession or in engineering school curriculums. Besides these major branches—11 of which are discussed separately in this chapter—there are many subdivisions of the branches. Structural, hydraulic, and highway engineering, for example, are subdivisions of civil engineering. Engineers may also become specialists in the engineering problems of one industry, or in a particular field of technology such as propulsion or guidance systems. Nevertheless, the basic knowledge required for all areas of engineering often makes it possible for engineers to shift from one field of specialization to another, particularly for those beginning their careers.

Engineers within each of the

branches may apply their specialized knowledge to many fields. For example, electrical engineers may work in medicine, missile guidance, or electric power distribution. Because engineering problems are usually complex, the work in some applied fields cuts across the traditional branches. Using a team approach to solve problems, engineers in one field often work closely with specialists in other scientific and engineering occupations.

Places of Employment

Engineering is the second largest professional occupation, exceeded in size only by teaching; for men it is the largest profession. Nearly 1.1 million engineers were employed in the United States in 1970.

Manufacturing industries employed approximately 600,000 or more than half of all engineers in 1970—mostly in electrical equipment, aircraft and parts, machinery, chemicals, ordnance, instruments, primary metals, fabricated metal products, and motor vehicles industries. Over 300,000 engineers were employed in non-manufacturing industries in 1970, primarily in the construction, public utilities, engineering and architectural services, and business and management consulting services industries.

Federal, State, and local governments employed more than 150,000 engineers in 1970. Over half of these were employed by the Federal Government, chiefly by the Department of Defense. Significant numbers of engineers also were in the Departments of the Interior, Agriculture, and Transportation, and the National Aeronautics and Space Administration. Most engineers in State and local government agencies were employed by highway and public works departments.

Educational institutions employed over 40,000 engineers in 1970, in research and teaching. A small number were employed by nonprofit research organizations.

Engineers are employed in every State, in small cities as well as large, and in some rural areas. However, about two-thirds of all engineers in private industry are employed in 10 States, and of these almost one-third are in California, New York, and Pennsylvania. The profession also offers opportunities for employment overseas. Some branches of engineering are concentrated in particular industries, as indicated in the statements presented later in this chapter.

Training, Other Qualifications, and Advancement

A bachelor's degree in engineering is the generally accepted educational requirement for entrance into engineering positions. Well-qualified graduates having training in physics, one of the other natural sciences, or in mathematics may qualify for some beginning positions in engineering. Some persons without a degree are able to become engineers after long experience in a related occupation—such as draftsmen or engineering technicians—and some college level training.

Advanced training is emphasized for an increasing number of jobs. Graduate degrees are desirable for beginning teaching and research positions, and advancement. Furthermore, some specialities, such as nuclear engineering, are available only at the graduate level.

About 270 colleges, universities, and engineering schools offer a bachelor's degree in engineering. These educational institutions offer nearly 1,000 curricula choices. Although the larger branches of engineering are offered in most schools, some specialties are taught in relatively few institutions. A student who desires to specialize should investigate various curriculums before selecting his college. For undergraduate admission, engineering schools usually require high school courses in mathematics and the physical sciences. The quality of the applicant's high school work is emphasized.

In the typical 4-year curriculum, the first 2 years are spent mainly on basic science—mathematics, physics, and chemistry—and the humanities, social sciences, and English. The last 2 years are devoted chiefly to engineering with emphasis on a specialty. Some programs offer general training; the student chooses a specialty in graduate school or acquires one on the job.

Some engineering curriculums require more than 4 years to complete. However, the number of institutions having 5-year programs leading to the bachelor's degree is decreasing. In addition, several engineering schools now have formal arrangements with liberal arts colleges whereby a student spends 3 years in liberal arts and 2 years in engineering and receives a bachelor's degree from each. This program offers the student diversification in his studies.

Some institutions have 5- or 6-year cooperative plans under which a student alternates school and employment. Most of these plans coordinate classroom study and practical experience. In addition to gaining experience, the student may finance part of his education.

Engineering graduates usually begin work as trainees or as assistants to experienced engineers. Many large companies have special programs to acquaint new engineers with special industrial practices and to determine the specialty for which they are best suited. As they gain experience, engineers may advance to positions of greater responsibility. Those with proven ability often become administrators. Increasingly large numbers are promoted to top executive posts. Many engineers obtain graduate degrees in business administration to improve their advancement opportunities.

All 50 States and the District of Columbia have laws providing for the licensing of those engineers whose work may affect life, health, or property; or who offer their services to the public. In 1970, about 325,000 engineers were registered under these laws in the United States. Generally, registration requirements include graduation from an accredited engineering curriculum, plus at least 4 years of experience and the passing of a State examination. Examining boards may accept a longer period of experience as a substitute for a college degree.

Prospective engineers should be able to work as part of a team, be innovative, have initiative, an analytical mind, a capacity for detail, and the ability to make decisions. In addition, engineers should be able to communicate their ideas to specialists in areas such as marketing, and production planning. The ability to cut across various disciplines and systematically evaluate and solve problems also is important. Because of rapidly changing technologies, an engineer must be willing to continue his education throughout his career.

Employment Outlook

Employment opportunities for engineers are expected to be favorable through the 1970's. Engineering has been one of the fastest growing professions in recent years and requirements for engineers are expected to increase very rapidly through the 1970's, but at a slower annual rate of growth than during the 1960's. Engineers who are not well grounded in fundamentals and whose specialization is very narrow could be affected adversely by shifts in defense activities and rapidly changing technology. Demand probably will be strong for new graduates who have acquired recently developed techniques, including computer applications, and for engineers who can apply engineering principles to medical, biological, and other sciences. New graduates having advanced degrees should have favorable opportunities in research and teaching.

Among factors underlying the anticipated increase in demand for engineers is population growth, and the resulting expansion of industry to meet the demand for more goods and services. The need for engineers also will rise as a result of the increasingly larger amount of engineering time required to develop complex industrial products and processes and industrial automation. Increasing public emphasis on solving domestic problems such as environmental pollution and urban redevelopment also should increase requirements for engineers.

Some of the past increases in engineering employment resulted from increases in Federal research and development (R&D) expenditures for space and defense related programs. During the 1970–80 decade R&D expenditures of Government and industry are expected to increase, although at a slower rate than during the 1960's. The anticipated slowdown in Federal R&D spending basically reflects anticipated reductions in the relative importance of the space and defense components of R&D expenditures. These trends were evidenced in the late 1960's and in 1970.

Defense expenditures are an important determinant of the demand for engineers because about 25 percent of all engineers in 1970 worked in defense related activities. The outlook for engineers presented is based on the assumption that defense activity as measured by expenditures will be somewhat higher than the level before the Vietnam buildup, approximating the level of the early 1960's. If defense activity should differ substantially from that level, the demand for engineers will be affected accordingly.

In addition to the level of defense expenditures, general business conditions, shifting National priorities, and nondefense related Federal programs and policies also influence the demand for engineers. Thus, the demand for engineers fluctuates periodically. The shortrun demand can either exceed or fall short of the number of engineers seeking professional employment. Over the longer run, however, indications are that engineers can look forward to favorable employment opportunities.

In addition to engineers for new positions, thousands will have to be trained to replace workers who transfer to other occupations, retire, or die. The preceding discussion analyzes the outlook for engineering as a whole. Various branches are discussed in statements later in this chapter.

Earnings and Working Conditions

New engineering graduates having the bachelor's degree and no experience earned an average of $10,400 a year in private industry in 1969–70 according to the College Placement Council. Master's degree graduates having no experience averaged almost $12,000 a year; Ph. D. graduates averaged about $16,000.

The accompanying tabulation shows varying starting salaries for bachelor degree graduates in 1969–70:

Starting salaries for engineers by branch, 1969–70

Branch	*Average*	*Lower decile* [1]	*Upper decile* [2]
Aeronautical engineering	$10,200	$10,000	$11,200
Chemical engineering	10,800	10,500	11,700
Civil engineering	10,000	9,400	11,000
Electrical engineering	10,400	10,000	11,300
Industrial engineering	10,200	9,700	11,100
Mechanical engineering	10,400	10,100	11,400
Metallurgical engineering	10,500	9,900	11,300

[1] 90 percent earned more than the amount shown.
[2] 10 percent earned more than the amount shown.

In the Federal Government in 1970 engineers having the bachelor's degree and no experience could start at $8,510 or $10,528 a year, depending on their college records. Beginning engineers having the bachelor's degree and 1 or 2 years of graduate work could start at $10,528 or $11,855. Those having the Ph. D. degree could begin at $13,493 or $14,665.

In colleges and universities, median salaries of engineers with the master's degree started at about $10,000 a year; and with the Ph. D. degree, $12,300 for a 9–10 month academic year. (Also see statement on College and University Teachers.)

Most engineers can expect an increase in earnings as they gain experience. For example, in 1970 according to an Engineering Manpower Commission Survey, the average (median) salary of engineers having 21 to 23 years of experience was $18,350, 78 percent higher than beginning engineers. Only 10 percent of those having 21 to 23 years of experience earned less than $13,700 a year, and 10 percent earned $25,600 or more. Some in top-level executive positions had much higher earnings.

Although engineers generally work under quiet conditions found in modern offices and research laboratories, they may be involved in more active work—at a missile site preceding the launching of a space vehicle, in a mine, at a construction site, or at some other outdoor location.

Sources of Additional Information

General information on engineering careers—including student selection and guidance, professional training and ethics, and salaries and other economic aspects of engineering—may be obtained from:

Engineers' Council for Professional Development, 345 East 47th St., New York, N.Y. 10017.

Engineering Manpower Commission, Engineers Joint Council, 345 East 47th St., New York, N.Y. 10017.

National Society of Professional Engineers, 2029 K St., NW., Washington, D.C. 20006.

Information on engineering

schools and curriculums and on training and other qualifications needed for entrance into the profession also may be obtained from the Engineers Council for Professional Development. Information on registration of engineers may be obtained from the National Society of Professional Engineers.

In addition to the organizations listed above, other engineering societies represent the individual branches of the engineering profession; some are listed with the branches presented later in this chapter. Each can provide information about careers in the particular branch of engineering. Many other engineering organizations are listed in the following publications available in most libraries or from the publisher.

Engineering Societies Directory, published by Engineers Joint Council, 345 East 47th Street, New York, N.Y. 10017.

Scientific and Technical Societies of the United States and Canada, published by the National Academy of Sciences, National Research Council.

Some engineers are members of labor unions. Information on engineering unions may be obtained from:

The American Federation of Technical Engineers (AFL-CIO), 1126 16th St. NW., Washington, D.C. 20036.

AEROSPACE ENGINEERS

(D.O.T. 002.081)

Nature of the Work

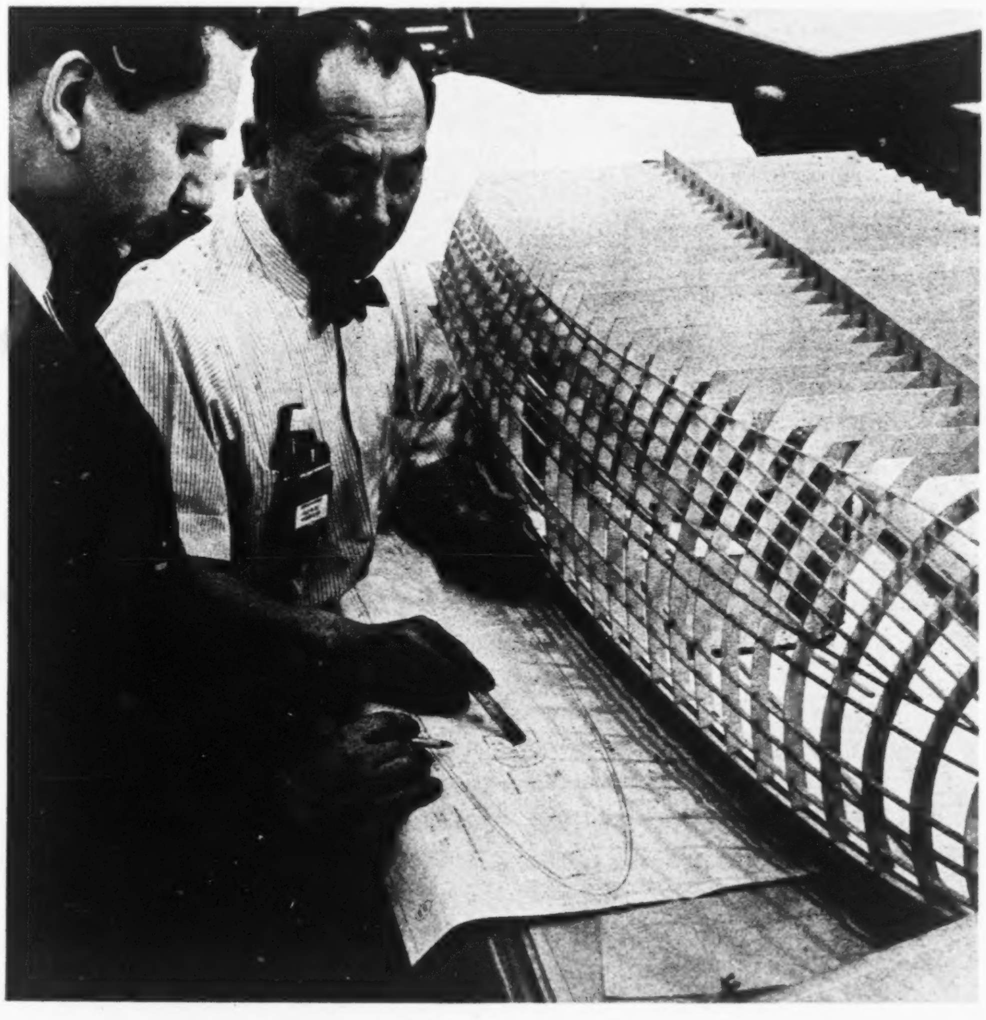
Aerospace engineers play a vital role in America's space activities. Engineers in this branch of the profession work on all types of aircraft and spacecraft including missiles, rockets, and conventional propeller-driven and jet-powered planes. They are concerned with all phases of the development of aerospace products from the initial planning and design to the final assembly, and testing.

Aerospace engineers usually specialize in a particular area of work, such as structural design, navigational guidance and control, instrumentation and communication, simulation, propulsion, materials, testing, or production methods. They also may specialize in a particular type of aerospace product such as passenger planes, jet-powered military aircraft, rockets, launch vehicles, satellites, manned space capsules, or landing modules.

Engineers working in the aircraft field are usually called aeronautical engineers. Those in the field of missiles, rockets, and spacecraft often are referred to as astronautical engineers. However, engineers with degrees in aeronautics and astronautics are usually called aerospace engineers.

Places of Employment

More than 60,000 aerospace engineers were employed in early 1970, mainly in the aircraft and parts industry. Some worked for Federal Government agencies, primarily the National Aeronautics and Space Administration and the



Department of Defense. Small numbers worked for commercial airlines, consulting firms, and colleges and universities.

Employment Outlook

Continuing developments in supersonic, subsonic, and vertical lift aircraft, and advancement in space and missile activities, such as the expansion of the Safeguard anti-ballistic-missile system (ABM) and space exploration followed by flights to the planets, should result in a moderate increase in requirements for aerospace engineers. Also, some aerospace firms may become active in other areas such as high speed ground transportation. Additional job opportunities also will arise from the need to replace engineers who transfer to other fields of work, retire, or die. However, engineers who are not well grounded in engineering fundamentals, and those whose specialization is very narrow, could be affected adversely by skill obsolescence caused by shifts in defense activities and by rapidly changing technology.

Employment requirements for aerospace engineers are particularly sensitive to changes in the level and mix of defense expenditures. Because of this, employment opportunities fluctuate periodically, and in the short run demand can fall short of the number of aerospace engineers seeking employment. Over the longer run, however, employment opportunities for aerospace engineers are expected to be favorable.

The outlook for aerospace engineers presented here is based on the assumption that defense activity as measured by expenditures will be reduced from the peak levels of the Vietnam conflict, although higher than the level just before the Vietnam conflict. If defense activity should differ substantially from that level, the demand for aerospace engineers would be affected accordingly. (See introductory section of this chapter for discussion on training requirements and earnings. See also chapter on Occupations in Aircraft, Missile, and Spacecraft Manufacturing.)

Sources of Additional Information

American Institute of Aeronautics and Astronautics, Inc., 1290 Avenue of the Americas, New York, N.Y. 10019.

AGRICULTURAL ENGINEERS

(D.O.T. 013.081)

Nature of the Work

Agricultural engineers use basic engineering principles and concepts to develop machinery, equipment and methods to improve the efficiency and economy of the production, processing, and distribution of food and other agricultural products. They are concerned primarily with the design of farm machinery, equipment, and structures; the utilization of electrical energy on farms and in food and feed processing plants; the conservation and management of soil and water resources; and the design and operation of processing equipment to prepare agricultural products for market. They usually specialize in a particular area of work, such as research and development, design, testing and application, production, sales, or management.

Places of Employment

Most of the estimated 13,000 agricultural engineers in 1970 were employed in private industry, especially by manufacturers of farm equipment and household equipment; electrical service companies; and distributors of farm equipment and supplies. Some worked for engineering consultants who supply technical or management services to farmers and farm related industries; others were independent consultants.

The Federal Government employs about 600 agricultural engineers—chiefly in the Soil Conservation Service and Agricultural Research Service of the Department of Agriculture. Some are employed by colleges and universities and a few are employed by State and local governments.

Employment Outlook

Employment of agricultural engineers is expected to grow rapidly through the 1970's. Among the factors which will contribute to a greater demand for these engineers are the growing mechanization of farm operations, increasing emphasis on conservation of resources, and expanding population—with a corresponding demand for food and fibre—and the broadening use of agricultural products and wastes as industrial raw materials. Additional engineers will be needed to work on problems concerning the enormous energy and power requirements of farms. (See introductory section of this chapter for discussion on training requirements and earnings. See also chapter on Occupations in Agriculture.)

Sources of Additional Information

American Society of Agricultural Engineers, 2950 Niles Rd., St. Joseph, Mich. 49085.

BIOMEDICAL ENGINEERS

(D.O.T. 019.481)

Nature of the Work

Biomedical engineers use engineering principles to solve medical and health related problems. Most biomedical engineers do research, working with life scientists, chemists, and the medical profession to study the engineering aspects of the biological systems of man and animals. Some design and develop medical instruments and devices that now include artificial hearts and kidneys to assist medical personnel in observing, mitigating, or alleviating physical ailments or deformities. Biomedical engineers have developed lasers for surgery and cardiac pacemakers for regulating the heartbeat. Other biomedical engineers adapt the computer to medical science, for example, computers to monitor patients and process electrocardiograph data. Biomedical engineers also design and construct systems which mechanize and automate laboratory and clinical procedures. A few biomedical engineers sell medical instruments and equipment to doctors, research centers, and hospitals.

Places of Employment

In 1970 most of the estimated 3,000 biomedical engineers were teaching and doing research in colleges and universities. Some were employed by the Federal Government, primarily in the National Aeronautics and Space Administration. Some work in State institutions and a growing number are employed in private industry to develop new apparatus, processes, and techniques, or in sales related positions.

Employment Outlook

Employment opportunities for biomedical engineers are expected to be very favorable through the 1970's. Although biomedical engineering currently is a small field and has few openings compared with the larger branches of engineering, the number of graduates also is small. Thus, opportunities should be very favorable for both new graduates and qualified scientists and engineers.

M.S. and Ph. D. graduates will be in strong demand to teach and fill positions resulting from increased expenditures for research in areas such as prosthetics and cybernetics. Research could create new positions in instrumentation and systems for the delivery of health services. (See introductory sections of this chapter for a discussion on training requirements and earnings.)

Sources of Additional Information

Alliance for Engineering in Medicine and Biology, 3900 Wisconsin Ave. NW., Suite No. 300, Washington, D.C. 20016.

Biomedical Engineering Society, P.O. Box 1600, Evanston, Illinois 60204.

Foundation for Medical Technology, Mt. Sinai Medical Center, 100 St., 5th, Ave., New York, N.Y. 10029.

CERAMIC ENGINEERS

(D.O.T. 006.081)

Nature of the Work

Ceramic engineers are concerned with one of the world's oldest and yet newest technologies. They develop methods for processing clay, silicates, and other nonmetallic minerals into a wide variety of ceramic products, ranging from glassware, cement, and bricks, to coatings and refractories for missile nose cones. They may also design and supervise the construction of the plant and equipment used to manufacture these products. Many ceramic engineers are engaged in research and development. Some are employed in administration, production and sales; others work as consultants or teach in colleges and universities.

Ceramic engineers usually specialize in one or more products—for example, products of refractories (fire- and heat-resistant materials, such as firebrick); whitewares (such as porcelain and china dinnerware or high voltage electrical insulators); structural materials (such as brick, tile, and terra cotta), electronic ceramics (such as ferrites for memory systems and microwave devices); protective and refractory coatings for metals; glass; abrasives; and fuel elements for atomic energy.

Places of Employment

Most of the estimated 10,000 ceramic engineers in 1970 were employed in manufacturing industries—primarily in the stone, clay, and glass industries. Others worked in the iron and steel, electrical equipment, aerospace, and chemical industries which produce or use ceramic products. Some were employed by educational institutions, independent research organizations, and the Federal Government.

Employment Outlook

The outlook is for rapid growth in the employment of ceramic engineers through the 1970's. Although ceramic engineering is a small field and has few openings in a year compared with large branches of engineering, the number of graduates also is small. Thus, opportunities for new graduates should be excellent.

The growth of programs related to nuclear energy, electronics, and space exploration will provide many of the opportunities for ceramic engineers. Ceramic materials which are corrosion-resistant, and capable of withstanding radiation and extremely high temperatures are becoming increasingly important in the development of nuclear reactors and space vehicles. Increasing use of the more traditional ceramic products, such as whitewares and abrasives, for consumer and industrial use also will require additional ceramic engineers to improve and adapt these products to new requirements. The growing use of structural clay and tile products in construction will add to employment opportunities. Furthermore, the development of new glasses of unusual properties and the expanding use of conventional glasses in the construction and container field probably will create additional openings for ceramic engineers. (See introductory section of this chapter for discussion on training requirements and earnings.)

Sources of Additional Information

American Ceramic Society, 4055 North High St., Columbus, Ohio 43214.

CHEMICAL ENGINEERS

(D.O.T. 008.081)

Nature of the Work

Chemical engineers design plants and equipment to manufacture chemicals and chemical products. They also determine the most efficient manufacturing process, which requires a knowledge of chemistry, physics, and mechanical and electrical engineering. They often design and operate pilot plants to test their work.

Chemical engineer checks water quality.

This branch of engineering is so diversified and complex that chemical engineers frequently specialize in a particular operation such as oxidation or polymerization. Others specialize in the manufacture of a specific product, such as plastics or rubber. Chemical engineers may engage in research and development, production, plant operation, design, sales, management, or teaching.

Places of Employment

Approximately four-fifths of the estimated 50,000 chemical engineers in the United States in 1970 were employed in manufacturing industries—primarily in the chemicals industry. Some were employed by government agencies and by colleges and universities. A small number worked for independent research institutes or engineering consulting firms, or as independent consulting engineers.

Employment Outlook

The outlook is for moderate growth of employment in chemical engineering through the 1970's. The major factors underlying this expected growth are expansion of industry—the chemicals industry in particular—and continued high levels of expenditures for research and development, in which a large portion of chemical engineers are employed. The growing complexity of chemical processes and the automation of these processes, will require additional chemical engineers for work related to designing, building, and maintaining the necessary plants and equipment. Chemical engineers also will be needed in many relatively new areas of work, such as environmental control and the design and development of nuclear reactors, and in research to develop new and better solid and liquid fuels for missiles and rockets. Furthermore, new chemicals used in the manufacture of consumer goods, such as plastics and manmade fibers, probably will create additional openings. (See introductory section of this chapter for discussion on training requirements and earnings. See also the statement on Chemists and chapter on Occupations in the Industrial Chemical Industry.)

Sources of Additional Information

American Institute of Chemical Engineers, 345 East 47th St., New York, N.Y. 10017.

CIVIL ENGINEERS

(D.O.T. 005.081)

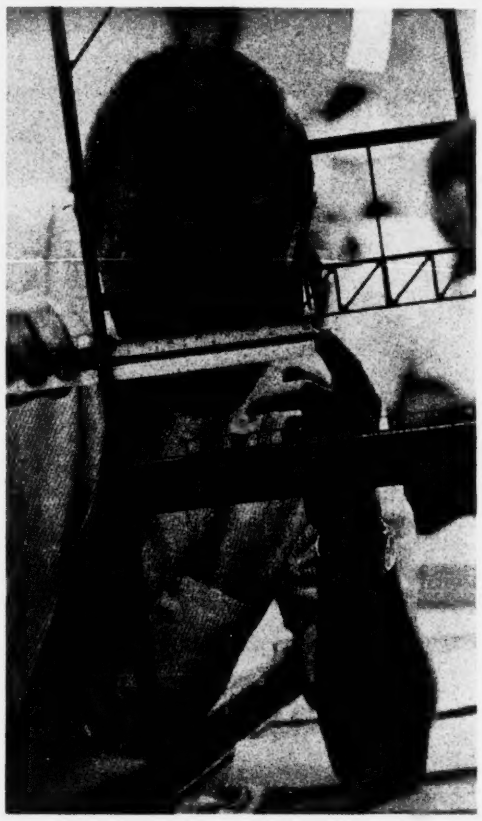
Nature of the Work

Civil engineers design and supervise the construction of roads, harbors, airfields, tunnels, bridges, water supply and sewage systems, and buildings. Major specialties within civil engineering are structural, hydraulic, sanitary, transportation (including highways and railways), and soil mechanics.

Many civil engineers are in supervisory or administrative positions ranging from site supervisor of a construction project or city engineer to top-level executive. Some are engaged in design, planning, research, inspection, or maintenance activities. Others teach in colleges and universities or work as consultants.

Places of Employment

Approximately 185,000 civil engineers were employed in the United States in 1970. The majority were employed by Federal, State, and local government agencies and the construction industry. Large numbers were employed by consulting engineering and architectural firms, or worked as independent consulting engineers. Some were employed by public utilities, railroads, and educational institutions. Others worked in the iron and steel industries and other major manufacturing industries.



Civil engineers work in all parts of the country, in every State and city—usually in or near the major industrial and commercial centers. However, since these engineers are frequently called upon to work at construction sites, they are sometimes stationed in remote areas of the United States or in foreign countries. Furthermore, civil engineers in some positions often are required to move from place to place to work on different projects.

Employment Outlook

The outlook in civil engineering—one of the largest and oldest branches of the profession—is for continued growth through the 1970's.

The expanding employment opportunities for civil engineers will result from the growing needs for housing, industrial buildings, and highway transportation systems created by an increasing population and expanding economy. Work related to the problems of urban environment, such as water and sewage systems, air and water pollution, and giant urban redevelopment projects, may also require additional civil engineers.

Large numbers of civil engineers will also be needed each year to replace those who retire or die. (See introductory section of this chapter for discussion on training requirements and earnings.)

Sources of Additional Information

American Society of Civil Engineers, 345 East 47th St., New York, N.Y. 10017.

ELECTRICAL ENGINEERS

(D.O.T. 003.081, .151, and .187)

Nature of the Work

Electrical engineers design, develop, and supervise the manufacture of electrical and electronic equipment—including electric motors and generators; communications equipment; electronic apparatus such as television, radar, computers, and missile guidance systems; and electrical applicances of all kinds. They also design and participate in the operation of facilities for generating and distributing electric power.

Electrical engineers usually specialize in a major area of work such as electronics, electrical equipment manufacturing, communications, or power. Many specialize in subdivisions of these broad areas; for example, electronics engineers may specialize in computers or in missile guidance and tracking systems.

A large number of electrical engineers are engaged in research, development, and design activities. Another large group is employed in administrative and management positions. Others are employed in various manufacturing operations or in technical sales or teaching positions.

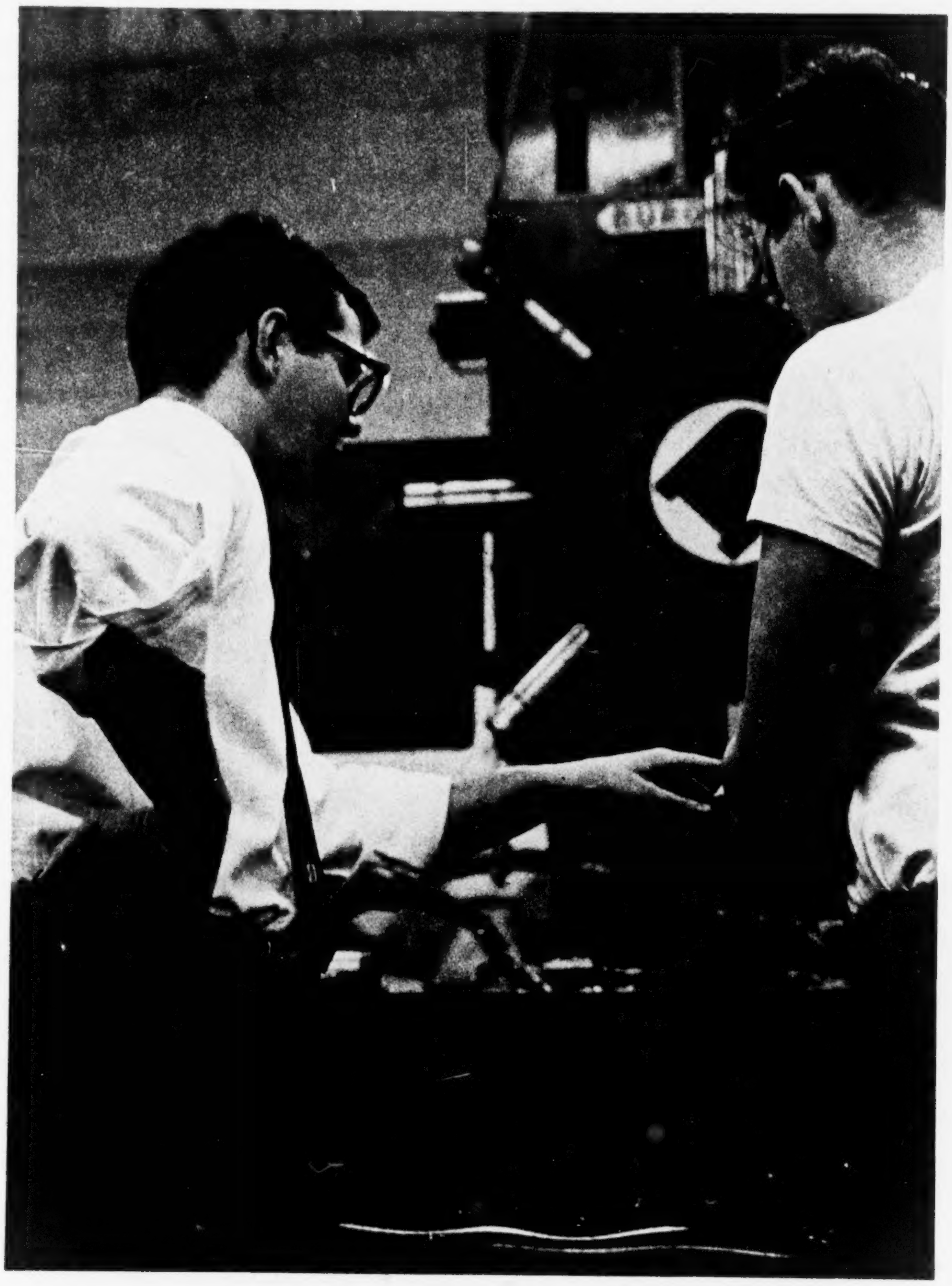
Places of Employment

Electrical engineering is the largest branch of the profession. It is estimated that more than 235,000 electrical engineers were employed in the United States in 1970 chiefly by manufacturers of electrical and electronic equipment, aircraft and parts, business machines, and professional and scientific equipment. Many were employed by telephone and telegraph and electric light and power companies. Sizable numbers were employed by government agencies and by colleges and universities. Others worked for construction firms, for engineering consultants, or as independent consulting engineers.

Employment Outlook

Employment opportunities for electrical engineers are expected to increase very rapidly through the 1970's. An increased demand for electrical equipment to automatically control production processes, using such items as computers and sensing devices, is expected to be among the major factors contributing to this growth. The anticipated growing demand for electrical and electronic consumer goods also is expected to create many job openings for electrical engineers.

The outlook for electrical engineers presented here is based on the assumption that defense activity (as measured by expenditures) will be reduced from the peak levels of the Vietnam conflict, although higher than the level just before the Vietnam conflict. If defense activity



Industrial engineer works with machine tool operator to set up production.

should differ substantially from that level, the demand for electrical engineers would be affected accordingly.

In addition to those needed to fill new positions, many electrical engineers will be needed to replace personnel who retire or die. (See introductory section of this chapter for discussions of training requirements and earnings. See also chapter on Occupations in Electronics Manufacturing.)

Sources of Additional Information

Institute of Electrical and Electronic Engineers, 345 East 47th St., New York, N.Y. 10017.

INDUSTRIAL ENGINEERS

(D.O.T. 012.081, .168 and .188)

Nature of the Work

Industrial engineers determine the most effective methods of using the basic factors of production—manpower, machines, and materials. They are concerned with people and "things," in contrast to engineers in other specialties who generally are concerned more with developmental work in subject fields, such as power, and mechanics.

They may design systems for data processing and apply operations research techniques to complex organizational, production, and related problems. Industrial engineers also develop management control systems to aid in financial planning and cost analysis; design production planning and control systems to insure coordination of activities and to control the quality of products; and may design and improve systems for the physical distribution of goods and services. Other activities of industrial engineers include plant location surveys, where consideration is given to sources of raw materials, availability of a work force, financing, and taxes; and the development of wage and salary administration and job evaluation programs.

Places of Employment

More than two-thirds of the estimated 125,000 industrial engineers employed in early 1970 were in manufacturing industries. They were more widely distributed among manufacturing industries than were those in other branches of engineering. Some worked for insurance companies, construction and mining firms, and public utilities. Others were employed by retail organizations and other large business enterprises to improve operating efficiency. Still others worked for government agencies and educational institutions. A few were independent consulting engineers.

Employment Outlook

The outlook is for very rapid growth of employment in this branch of the profession through the 1970's. The increasing complexity of industrial operations and the expansion of automated processes, coupled with the growth of the Nation's industries, are among the major factors expected to increase the demand for industrial engineers. Growing recognition of the importance of scientific management and safety engineering in reducing costs and increasing productivity also is expected to stimulate the demand for persons in this branch of engineering.

Besides those needed to fill new positions, additional numbers of industrial engineers will be required each year to replace those who retire or die. (See introductory section of this chapter for discussion on training requirements and earnings.)

Sources of Additional Information

American Institute of Industrial Engineers, Inc., 345 East 47th St., New York, N.Y. 10017.

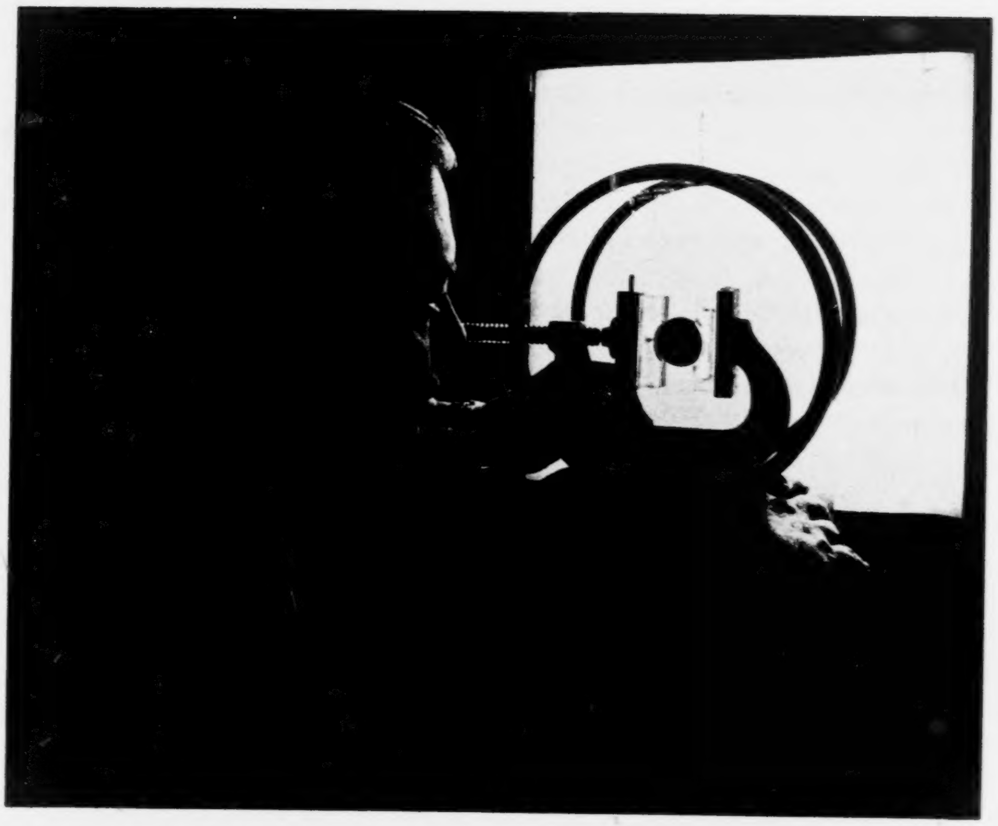
MECHANICAL ENGINEERS

(D.O.T. 007.081, .151, .168, .181, and .187; 011.081; and 019.187)

Nature of the Work

Mechanical engineers are concerned with the production, transmission, and use of power. They design and develop machines which produce power, such as internal combustion engines, steam and gas turbines, jet and rocket engines, and nuclear reactors. They also design and develop a great variety of machines which use power—refrigeration and air conditioning equipment, elevators, machine tools, printing presses, steel rolling mills, and many others.

Many specialized areas of work have developed within mechanical engineering, and because they are employed in nearly all industries, their specific work varies with the industry and the function performed. Among these specialties are those concerned with motor vehi-



Mechanical engineer examines model of ball bearing.

cles, marine equipment, railroad equipment, rocket engines, steampower, heating, ventilating and air conditioning, hydraulics or fluid mechanics, instrumentation, ordnance, and machines for specialized industries, such as petroleum, rubber and plastics, and construction.

Large numbers of mechanical engineers are engaged in research, development, and design. Many also are employed in administrative and management activities. Others work in maintenance, sales, and activities related to production and operations in manufacturing industries. Some teach in colleges and universities or work as consultants.

Places of Employment

About 220,000 mechanical engineers were employed in the United States in 1970. Nearly all manufacturing and nonmanufacturing industries employed some members of the profession. However, nearly three-fourths of all mechanical engineers were employed in manufacturing industries—mainly in the primary and fabricated metals, machinery, transportation equipment, and electrical equipment industries. Others were employed in government agencies, educational institutions, and consulting engineering firms. Some worked as independent consulting engineers.

Employment Outlook

The outlook in mechanical engineering—the second largest branch of the profession—is for rapid growth through the 1970's. The expected expansion of industry with the consequent demand for industrial machinery and machine tools, and the increasing technological complexity of industrial machinery and processes will be among the major factors contributing to greater employment. Continued growth of expenditures for research and development also will be a factor in the growth of this branch of the profession. Moreover, newer areas of work, such as atomic energy, aerospace development, and environmental control, will probably provide additional openings for large numbers of mechanical engineers.

Besides those needed to fill new positions, large numbers of mechanical engineers will be required each year to replace those who retire or die. (See introductory section of this chapter for discussion on training requirements and earnings.)

Sources of Additional Information

The American Society of Mechanical Engineers, 345 East 47th St., New York, N.Y. 10017.

METALLURGICAL ENGINEERS

(D.O.T. 011.081)

Nature of the Work

Metallurgical engineers develop methods of processing and converting metals into useful products. These engineers usually work in 1 of 2 main branches of metallurgy —extractive or physical. Extractive metallurgy involves the extraction of metals from ores and their refining to obtain pure metal. Physical metallurgy deals with the properties of metals and their alloys, and with methods of converting refined metals into useful final products. Scientists working in this field are known as metallurgists, but the distinction between scientists and engineers in this field is small. Persons working in the field of metallurgy are sometimes referred to as either materials scientists or materials engineers.

Places of Employment

The metalworking industries—primarily the iron and steel and nonferrous metals industries—employed over one-half of the estimated 5,000 to 10,000 metallurgical engineers in 1970. Many metallurgical engineers worked in the machinery, electrical equipment, and aircraft and parts industries. Others were employed in the mining industry, government agencies, consulting firms, independent research organizations, and educational institutions.

Employment Outlook

Employment in this small branch of the profession is expected to grow rapidly through the 1970's. Increasing numbers of metallurgical engineers will be needed by the metalworking industries to work on problems involving the development of new metals and alloys as well as the adaption of current ones to new needs. For example, the development of such products as supersonic jet aircraft, missiles, satellites, and spacecraft has brought about a need for lightweight metals capable of withstanding both extremely high and extremely low temperatures. Metallurgical engineers also will be needed to solve metallurgical problems connected with the efficient use of nuclear energy. Furthermore, as the supply of highgrade ores diminishes, more metallurgical engineers will be needed to find ways of processing low-grade ores now regarded as unprofitable to mine. (See introductory section of this chapter for discussions on training requirements and earnings. Also see chapter on Occupations in the Iron and Steel Industry.)

Sources of Additional Information

The Metallurgical Society of the American Institute of Mining, Metallurgical, and Petroleum Engineers, 345 East 47th St., New York, N.Y. 10017.

American Society of Metals, Metals Park, Ohio 44073.

MINING ENGINEERS

(D.O.T. 010.081 and .187)

Nature of the Work

Mining engineers find and extract minerals from the earth and prepare minerals for use by manufacturing industries. They design the layouts of mines, supervise the construction of mine shafts and tunnels in underground operations, and devise methods of transporting extracted minerals to processing plants. Mining engineers are responsible for the efficient operation of mines and mine safety, including ventilation, water supply, power, communications, and maintenance of equipment. Some mining engineers work with geologists and metallurgical engineers to locate and appraise new ore deposits. Others develop new mining equipment and devise improved methods to process extracted minerals.

Mining engineers frequently specialize in the extraction of specific metal ores or coal and other nonmetallic minerals. Engineers who specialize in the extraction of petroleum and natural gas are usually considered members of a separate branch of the engineering profession—Petroleum Engineering.

Places of Employment

Most of the estimated 5,000 mining engineers were employed in the mining industry in 1970. Some worked in colleges and universities or government agencies, or as independent consultants. Others worked for firms producing equipment for the mining industry.

Mining engineers are usually employed at the location of mineral deposits, often near small communities. However, those engaged in research, teaching, management, consulting, or sales are often located in large metropolitan areas.

In addition to mining engineers, many other engineers in different branches also are employed in the mining industry.

Employment Outlook

Employment opportunities for mining engineers are expected to be favorable through the 1970's. The number of new graduates in mining engineering entering the industry is expected to be fewer than the number needed to provide for the anticipated growth in requirements and to replace those who retire, transfer to other fields of work, or die.

Exploration for minerals is increasing, both in the United States and in other parts of the world. Easily mined deposits are being depleted, creating a growing need for engineers to mine newly discovered mineral deposits and to devise more efficient methods for mining low-grade ores. Additional employment opportunities for mining engineers will arise as new alloys and new uses for metals increase the demand for less widely used ores. Recovery of metals from the sea and the development of recently discovered oil shale deposits could present major challenges to the mining engineer. (See introductory section to chapter for discussion on training requirements and earnings. See also chapter on Mining.)

Sources of Additional Information

The Society of Mining Engineers of the American Institute of Mining, Metallurgical, and Petroleum Engineers, 345 East 47th St., New York, N.Y. 10017.

HEALTH SERVICE OCCUPATIONS

Almost everyone knows something about the professional services provided by doctors, dentists, and pharmacists. Many also have some firsthand knowledge of the duties performed by nurses, attendants, and other workers who take care of patients in hospitals. Less well known, but also of great importance to the public health, is the work of large numbers of workers employed behind the scenes in other health service occupations, such as laboratory or X-ray technician. Altogether, more than 3.5 million people were employed in health related occupations in 1970. Employment in this field has increased rapidly in recent years.

Nurses, physicians, pharmacists, and dentists constituted the largest professional health occupations in 1970, and ranged from 103,000 dentists to 700,000 registered nurses. Other professional health occupations are dietitian, veterinarian, optometrist, chiropractor, osteopathic physician, and hospital administrator. Other health service workers include technicians of various types, such as medical technologist, medical X-ray technician, dental hygienist, and dental laboratory technician. Large numbers—1.2 million—worked as practical nurses and auxiliary nursing workers, including orderlies, nursing aids, hospital attendants, and psychiatric assistants.

Workers in the health field are employed in hospitals, clinics, laboratories, pharmacies, nursing homes, industrial plants, public health agencies, mental health centers, private offices, and patients' homes. Those employed in health occupations work mainly in the more heavily populated and prosperous sections of the Nation.

Many women are employed in the health field. Nursing, the largest of the major health service occupations, is second only to teaching as a field of professional employment for women. Other health service occupations in which women predominate are practical nurse, radiologic technologist, medical technologist, dietitian, physical therapist, occupational therapist, speech pathologist and audiologist, dental hygienist, dental assistant, and medical record librarian. On the other hand, most dentists, optometrists, physicians, veterinarians, pharmacists, hospital administrators, and sanitarians are men.

The educational and other requirements for work in the health field are as diverse as the health occupations themselves. For example, professional health workers—physicians, dentists, pharmacists, and others—must complete a number of years of preprofessional and professional college education and pass a State licensing examination. On the other hand, some health service occupations can be entered with little specialized training.

A continued rapid expansion of employment in the health field is expected through the 1970's, although the rates of growth will differ considerably among individual health occupations. The factors that are expected to contribute to an increase in the demand for health care are the following: The country's expanding population; rising standards of living; increasing health consciousness; growth of coverage under prepayment programs for hospitalization and medical care, including Medicare; rapid expansion of expenditures for medical research; and increasing expenditures by Federal, State, and local governments for health care and services. In addition, many new workers will be needed each year to replace those who retire, die, or—particularly for women—leave the field for other reasons. Thus, many opportunities will be available for employment in the health services.

PHYSICIANS

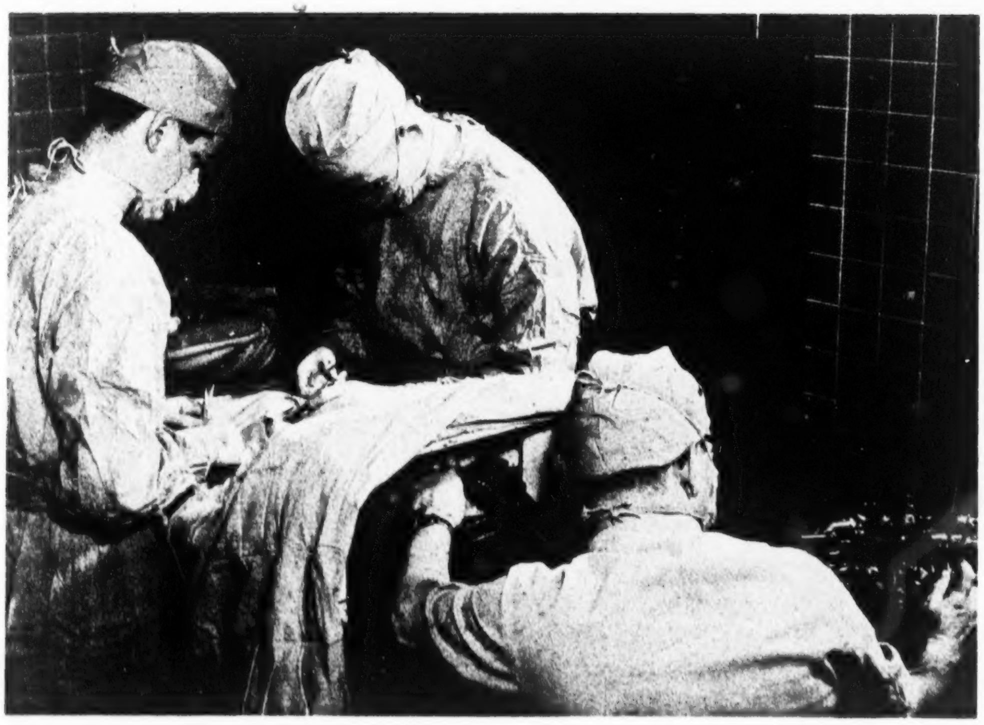
(D.O.T. 070.101 and .108)

Nature of the Work

Physicians diagnose diseases and treat people who are in poor health. In addition, they are concerned with preventive medicine and with the rehabilitation of people who are injured or ill.

Physicians generally examine and treat patients in their own offices and in hospitals, but they also visit patients at home when necessary. Some physicians combine the practice of medicine with research or teaching in medical schools. Others hold full-time research or teaching positions or perform administrative work in hospitals, professional associations, and other organizations. A few are primarily engaged in writing and editing medical books and magazines.

In 1970, one-fifth of the physicians providing patient care were general practitioners; the others specialized in 1 of the 33 fields recognized by the medical profession. In recent years, the trend has been toward specialization. Among the largest specialties are internal medicine, general surgery, obstetrics and gynecology, psychiatry, pediatrics, radiology, anesthesiology, oph-



thalmology, pathology, and orthopedic surgery.

Places of Employment

More than 305,000 physicians—of whom 7 percent were women—were professionally active in the United States in 1970. About 90 percent were primarily engaged in providing patient care services. More than 190,000, or 7 out of 10 of these, were in office based practice; nearly 83,000 were interns, residents, or full-time staff in hospitals. Nearly 32,000 physicians were working primarily in activities other than providing patient care services such as medical teaching, administration, and research.

In 1970, about 40 percent of all nonfederal physicians were in New York, California, Pennsylvania, Illinois, and Ohio. In general, the Northeastern States have the highest ratio of physicians to population and the Southern States, the lowest. General practitioners are much more widely distributed geographically than specialists, who tend to be concentrated in large cities.

Training and Other Qualifications

A license to practice medicine is required in all States and the District of Columbia. To qualify for a license, a candidate must graduate from an approved medical school, pass a licensing examination, and —in 33 States and the District of Columbia—serve a 1-year hospital internship. As of 1970, 16 States permitted a candidate to take the medical licensing examination upon graduation from medical school. Eleven States and the District of Columbia require candidates to pass a special examination in the basic sciences to become eligible for the medical licensing examination.

Licensing examinations are given by State boards. The National Board of Medical Examiners also gives an examination which is accepted by 47 States and the District of Columbia as a substitute for State examinations. Although physicians licensed in one State usually can obtain a license to practice in another without further examination, some States limit this reciprocity.

In 1970, there were 92 approved schools in the United States in which students could begin the study of medicine. Eighty-six awarded the degree of Doctor of Medicine (M.D.) to those completing the 4-year course; 6 offered 2-year programs in the basic medical sciences to students who could then transfer to regular medical schools for the last 2 years of study. Eight additional new schools were enrolling medical students, but had not yet graduated a class. Because the number of people applying to medical schools exceeds the beginning enrollment capacity, preference is given to the most highly qualified applicants.

Most medical schools require applicants to have completed at least 3 years of college education for admission to their regular programs, and some require 4 years. A few medical schools allow selected students having exceptional qualifications to begin their professional study after completing 2 years of college. The great majority of students entering medical schools have a bachelor's degree.

Premedical study must include undergraduate courses in English, physics, biology, and inorganic and organic chemistry in an accredited college. Students should acquire a broad general education by taking courses in the humanities, mathematics, and the social sciences. Other factors considered by medical schools in selecting students include the individual's college record; and his scores on the Medical College Admission Test, which is taken by almost all applicants. Consideration also is given to the applicant's character, personality, and leadership qualities, as shown by personal interviews, letters of recommendation, and extracurricular activities in college. In addition, many State-supported medical schools give preference to residents of their particular States and, sometimes, those of nearby States.

The first 2 years of medical school training generally are spent primarily in laboratories and classrooms, learning basic medical sciences, such as anatomy, biochemistry, physiology, pharmacology, microbiology, and pathology. During the last 2 years, students spend most of their time in hospitals and clinics under the supervision of experienced physicians. They learn to take case histories, perform examinations, and recognize diseases.

New physicians increasingly are acquiring training beyond the 1-year hospital internship. Those who plan to be general practitioners often spend an additional year or two as interns or residents in a hospital. To become certified specialists, physicians must pass specialty board examinations. To qualify for these examinations, they must spend from 2 to 4 years—depending on the specialty—in advanced hospital training as residents, followed by 2 years or more of practice in the specialty. Some doctors interested in teaching and research take graduate work leading to the master's or Ph. D. degree in a field such as biochemistry or microbiology.

Many graduates of foreign medical schools serve as hospital interns and residents in this country. In 1970, this group numbered about 16,000 including citizens of foreign countries as well as U.S. citizens. To be appointed to approved internships or residencies in U.S. hospitals, however, these graduates (citizens of foreign countries as well as U.S. citizens) must pass the American Medical Qualification Examination given by the Educational Council for Foreign Medical Graduates.

Medical training is very costly because of the long time required to earn the medical degree. However, the Health Professions Educational Assistance Act of 1963, as amended, provides Federal funds for loans and scholarships of up to $2,500 a year to help needy students pursue full-time study leading to the degree of Doctor of Medicine.

Persons considering entering the medical profession must have a strong desire to serve the sick and injured. They must be willing to study a great deal to keep up with the latest advances in medical science. Besides being one of the most exacting sciences, medicine demands that practitioners strictly adhere to high moral standards subscribed to by the profession, law, and tradition. Sincerity and a pleasant personality are assets which help physicians gain the confidence of patients. In addition, prospective physicians should be emotionally stable and able to make decisions in emergencies.

The majority of newly qualified physicians open their own offices. Those who have completed their internships and enter active military duty initially serve as captains in the Army or Air Force or as lieutenants in the Navy. Graduates of accredited medical schools are eligible for commissions as senior assistant surgeons (equivalent to lieutenants in the Navy) in the U.S. Public Health Service, as well as for Federal Civil Service professional medical positions.

Employment Outlook

Excellent opportunities are anticipated for physicians through the 1970's. Because the number of new physicians being trained is restricted by the present limited capacity of medical schools, the employment of physicians is expected to grow only moderately, despite a steady increase in the demand for their services. However, some expansion in medical school facilities is expected because of recent Federal legislation which provides Federal funds to assist in the construction of new training facilities for physicians. Nonetheless, any increase in the supply of physicians resulting from the implementation of this legislation may not be significant until the late 1970's.

Increased demand for physicians' services will result from factors such as the anticipated population growth, including rising numbers of older persons—the group requiring extensive physicians' services; the increasing health consciousness of the public; and the trend toward higher standards of medical care. The demand for physicians also will increase because of the extension of prepayment programs for hospitalization and medical care, including Medicare and Medicaid; continued Federal Government provision of medical care for members of the Armed Forces, their families, and veterans; and the continuing growth in the fields of public health, rehabilitation, industrial medicine, and mental health. In addition, more physicians will be needed for medical research and to teach in medical schools.

In addition to those needed to fill new openings, many newly trained doctors will be required to replace those who retire or die.

To some extent, the rise in the demand for physicians' services will be offset by developments that are enabling physicians to care for more patients. For example, increasing numbers of medical technicians are assisting physicians; new drugs and new medical techniques are shortening illnesses; and growing numbers of physicians are able to use their time more effectively by engaging in group practice. In addition, fewer house calls are being made by physicians because of the growing tendency to treat patients in hospitals and physicians' offices. However, these developments are not expected to offset the overall need for more physicians.

Earnings and Working Conditions

New graduates serving as interns in 1970 had an average annual salary of $7,045 in hospitals affiliated with medical schools and $7,435 in other hospitals. Residents during 1970 earned average annual salaries of $8,250 in hospitals affiliated with medical schools and $8,750 in nonaffiliated hospitals, according to the American Medical Association. Many hospitals also provided full or partial room, board, and other maintenance allowances to their interns and residents.

Graduates employed by the Federal Government in 1970 could expect to receive an annual starting salary of about $15,200 if they had completed their internship, and about $17,800 if they had completed 1 year of residency or demonstrated superior achievement during their internship.

Newly qualified physicians who establish their own practice must make a sizable financial investment to equip a modern office. It is estimated that during the first year or two of independent practice, physicians probably earn little more than the minimum needed to pay the expenses for maintaining their offices. As a rule, however, their earnings rise rapidly as their practice develops.

The net income of physicians providing patient care services was generally between $34,000 and $39,000 in 1970, according to the limited information available. Earnings of physicians depend on factors such as the region of the country in which they practice; the patients' income level; and the physician's skill, personality, and professional reputation, as well as his length of experience. Self-employed physicians usually earn more than those in salaried positions, and specialists usually earn considerably more than general practitioners. Many physicians have long working days and irregular hours. Most specialists work fewer hours each week than general practitioners. As doctors grow older, they may not accept new patients and tend to work fewer hours. However, many continue in practice well beyond 70 years of age.

Sources of Additional Information

Persons wishing to practice in a given State should find out about the requirements for licensure directly from the board of medical examiners of that State. Lists of approved medical schools, as well as general information on premedical education and medicine as a career, may be obtained from:

Council on Medical Education, American Medical Association, 535 North Dearborn St., Chicago, Ill. 60610.

Association of American Medical Colleges, One Dupont Circle NW., Washington, D.C. 20036.

OSTEOPATHIC PHYSICIANS

(D.O.T. 071.108)

Nature of the Work

Osteopathic physicians diagnose, prescribe remedies, and treat diseases of the human body. They pay particular attention to impairments in the musculoskeletal system. They emphasize manual manipulative therapy, but in most States, they also use surgery, drugs, and all other accepted methods of medical care. Most osteopathic physicians are "family doctors" who engage in general practice. These physicians usually see patients in their offices, make house calls, and treat patients in osteopathic and some city and county hospitals. A few doctors of osteopathy are engaged primarily in research, teaching, or writing and editing scientific books and journals. In recent years, there has been an increase in specialization. The specialties include: Internal medicine, neurology and psychiatry, ophthalmology and otorhinolaryngology, pediatrics, anesthesiology, physical medicine and rehabilitation, dermatology, obstetrics and gynecology, pathology, proctology, radiology, and surgery.

Places of Employment

About 13,500 osteopathic physicians were practicing in the United States in 1970; approximately 7 percent were women. Nearly all of them were in private practice. Less than 5 percent had full-time salaried positions, mainly in osteopathic hospitals and colleges. A few were employed by private industry or government agencies.

Osteopathic physicians are located chiefly in those States which have osteopathic hospital facilities. In 1970, about half of all osteopathic physicians were in Michigan, Pennsylvania, Ohio, Missouri, and Texas. Twenty-three States and the District of Columbia each had fewer than 50 osteopathic physicians. More than half of all general practitioners are located in towns and cities having less than 50,000 people; specialists, however, practice mainly in large cities.

Training and Other Qualifications

A license to practice as an osteopathic physician is required in all States. In 1970, licensed osteopathic physicians were qualified to engage in all types of medical and surgical practice in 48 States and the District of Columbia. The remaining States limit in varying degrees the use of drugs or the type of surgery that can be performed by osteopathic physicians.

To obtain a license, a candidate must be a graduate of an approved school of osteopathy and pass a State board examination. In 21 States and the District of Columbia, the candidate must pass an examination in the basic sciences before he is eligible to take the professional examination; 29 States and the District of Columbia also require a period of internship in an approved hospital after graduation from an osteopathic school. All States except Alaska, California, Florida, and Mississippi grant licenses without further examination to properly qualified osteopathic physicians already licensed by another State.

Although 3 years of preosteopathic college work is the minimum requirement for entry to schools of osteopathy, 4 years is preferred. Osteopathic colleges require successful completion of 4 years of professional study for the degree of Doctor of Osteopathy (D.O.) Preosteopathic education must include courses in chemistry, physics, biology, and English. During the first 2 years of professional training, emphasis is placed on basic sciences such as anatomy, physiology, pathology and on the principles of osteopathy; the last 2 years are devoted largely to work with patients in hospitals and clinics.

After graduation, almost all doctors of osteopathy serve a 12-month internship at 1 of the 80 osteopathic hospitals which the American Osteopathic Association has approved for intern training. Those who wish to become specialists must have 3 to 5 years of additional training, followed by 2 years of supervised practice in the specialty.

The osteopathic physician's training is very costly because of the length of time it takes to earn the degree of Doctor of Osteopathy. However, the Health Professions Educational Assistance Act of 1963, as amended, provides Federal funds for loans and scholarships of up to $2,500 a year to help needy students pursue full-time study leading to the degree.

Every year, more young people apply for admission to the 7 approved schools of osteopathy than can be accepted. In selecting students, these colleges consider grades received in preprofessional education, scores on medical aptitude tests, and the amount of preosteopathic college work completed. In 1970, over 90 percent of the students entering osteopathic colleges had bachelor's degrees. The applicant's desire to serve as an osteopathic physician rather than as a doctor trained in other fields of medicine is a very important qualification. The colleges also give considerable weight to a favorable recommendation by an osteopathic physician familiar with the applicant's background.

Newly qualified doctors of osteopathy usually establish their own practice. A few work as assistants to experienced physicians or become associated with osteopathic hospitals. In view of the variation in State laws regulating the practice of osteopathy, persons wishing to become osteopathic physicians should study carefully the professional and legal requirements of the State in which they plan to practice. The availability of osteopathic hospitals and clinical facilities also should be considered when choosing a location.

Persons desiring to become osteopathic physicians must have a strong desire to practice osteopathic principles of healing. They should have a keen sense of touch, emotional stability, self-confidence, and perseverance. A pleasant personality, friendliness, patience, and the ability to deal with people are important.

Employment Outlook

Opportunities for osteopathic physicians are expected to be excellent through the 1970's. Greatest demand for their services probably will continue to be in States where osteopathy is a widely accepted method of treatment, such as Pennsylvania and a number of Midwestern States. Generally, prospects for beginning a successful practice are likely to be best in rural areas, small towns, and city suburbs, where the young doctor of osteopathy may encounter less competition and therefore establish his professional reputation more easily than in the centers of large cities.

The demand for the services of osteopathic physicians is expected to grow through the 1970's because of factors such as the anticipated population growth, the extension of prepayment programs for hospitalization and medical care including Medicare and Medicaid, and the trend toward higher standards of health care. Furthermore, there is a likelihood of greater public acceptance of osteopathy, liberalization of certain State restrictions on the use of drugs and surgery by osteopathic physicians, and the establishment of additional osteopathic hospitals.

Despite the expected growth in demand, the employment of osteopathic physicians is expected to increase only moderately because the number of new osteopathic physicians being trained is restricted by the limited capacity of osteopathic colleges. Approximately half of all graduates expected each year through the 1970's probably will be needed to replace osteopathic physicians who retire, die, or leave the profession for other reasons; hence the number of new graduates will be barely sufficient to maintain the present ratio of osteopathic physicians to population. Although some expansion in osteopathic college facilities is anticipated because of recent Federal legislation, which provides Federal funds to assist in the construction of new teaching facilities for osteopathic physicians, no significant increase in graduates is expected through the 1970's.

Earnings and Working Conditions

In osteopathy, as in many of the other health professions, incomes usually rise markedly after the first few years of practice. Earnings of individual practitioners are determined mainly by such factors as ability, experience, the income level of the community served, and geographic location. The average income above business expenses of general practitioners, in 1970, ranged from $25,000 to $30,000, according to the limited data available. Specialists usually had higher incomes than general practitioners.

Many osteopathic physicians work more than 50 or 60 hours a week. Those in general practice work longer and more irregular hours than specialists.

Sources of Additional Information

Persons wishing to practice in a given State should find out about the requirements for licensure directly from the board of examiners of that State. A list of State boards, as well as general information on osteopathy as a career, may be obtained from:

American Osteopathic Association,
212 East Ohio St., Chicago, Ill.
60611.

DENTISTS

(D.O.T. 072.108)

Dentists examine teeth and other tissues of the mouth to diagnose diseases or abnormalities. They take X-rays where necessary, fill cavities in the teeth, straighten teeth, and treat gum diseases. Dentists extract teeth and substitute artificial dentures especially designed for the individual patient. They also perform corrective surgery of the gums and supporting bones. In addition, they may clean teeth.

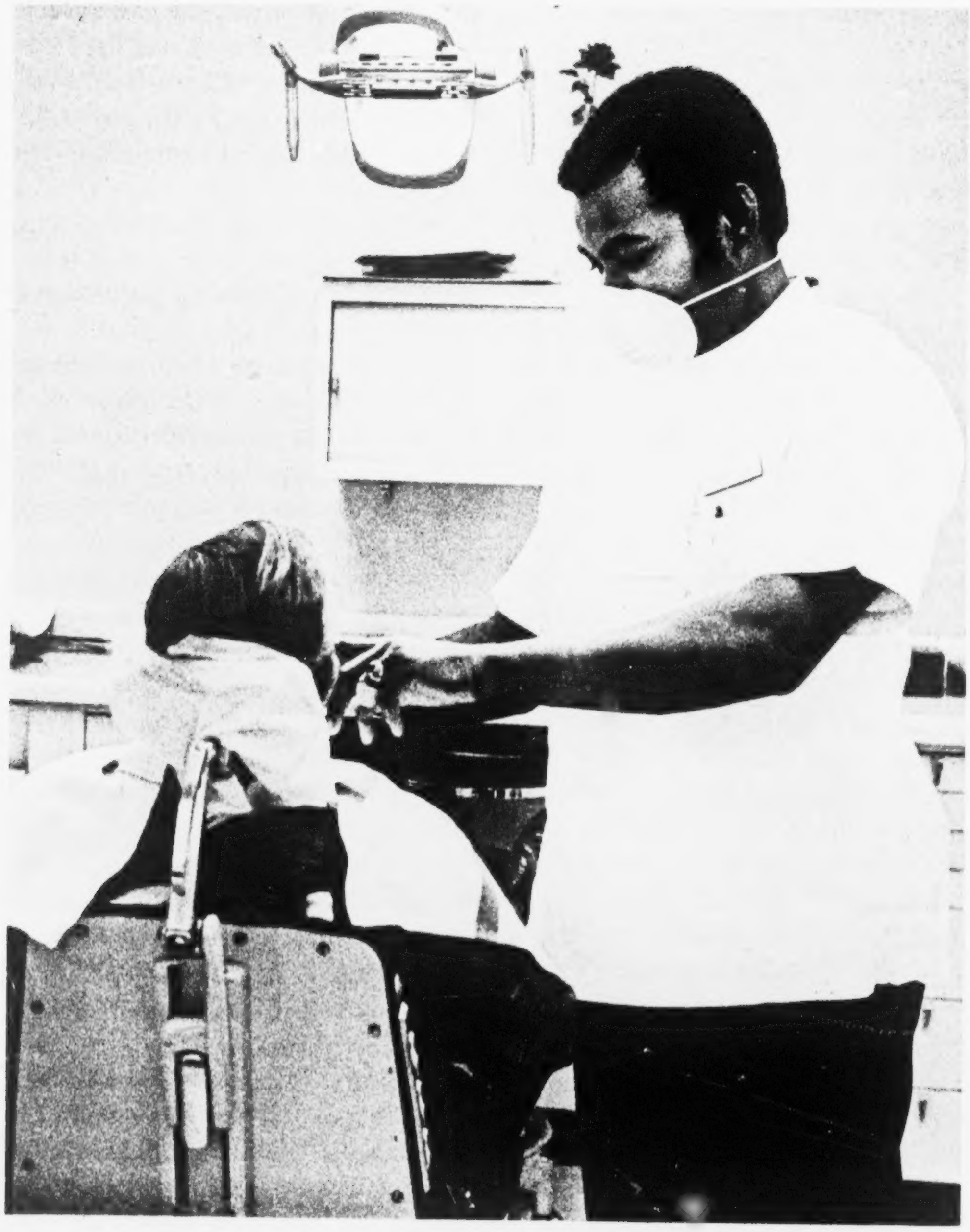
Dentists spend most of their time with patients, but may devote some time to laboratory work such as making dentures and inlays. Many dentists, however—particularly in large cities—send most of their laboratory work to commercial firms. Some dentists also employ dental hygienists to clean patients' teeth and for other duties. (See statement on Dental Hygienists.) They also may employ other assistants who perform office work and assist in "chairside" duties.

Most dentists are general practitioners who provide many types of dental care; approximately 9 percent are specialists. Nearly half of these specialists are orthodontists, who straighten teeth. The next larger number, oral surgeons, operate in the mouth and jaws. The remainder specialize in pedodontics (dentistry for children); periodontology (treating the tissues that support the teeth); prosthodontics (making artificial teeth or dentures); endodontics (root canal therapy); public health dentistry; and oral pathology (diseases of the mouth).

About 3 percent of all dentists are employed primarily in work that does not involve "chairside" practice, such as teaching, research, and administration. Many dentists in private practice, however, do this work on a part-time basis.

Places of Employment

Approximately 103,000 dentists were at work in the United States in 1970. About 9 of every 10 were in private practice. Of the remainder, about 6,500 served as commissioned officers in the Armed Forces; about 1,300 had other types of Federal Government positions—chiefly in the hospitals and clinics of the Veterans Administration and the



Public Health Service; and some 3,500 held full-time positions in schools, hospitals, or State and local health agencies. Women dentists represented only about 1 to 2 percent of the profession.

Dentists tend to be concentrated in large cities and in populous States. In early 1970, about a third of all dentists were located in New York, California, Pennsylvania, and Illinois.

Training, Other Qualifications, and Advancement

A license to practice dentistry is required in all States and the District of Columbia. To qualify for a license, a candidate must be a graduate of an approved dental school and pass a State board examination. In 1970, 48 States and the District of Columbia recognized the examination given by the National Board of Dental Examiners as a substitute for the written part of the State board examinations. One State, Delaware, also requires new graduates to serve 1 year of hospital internship. Most State licenses permit dentists to engage in both general and specialized practice. In 13 States, however, a dentist cannot be licensed as a "specialist" unless he has 2 or 3 years of graduate education, and several years of specialized experience, and passes a special State examination. Few States permit dentists licensed in other States to practice in their jurisdictions without further examination.

Ordinarily, the minimum education requirements for graduation from an approved dental school is 2 years of predental college work followed by 4 years of professional dental school training; 23 of the 53 dental schools in operation in the United States in 1970 required 3 years of predental study. Predental education must include courses in sciences and the humanities.

In dental college, the first 2 years are usually devoted to classroom instruction and laboratory work in basic sciences such as anatomy, microbiology, and physiology. The last 2 years are spent chiefly in the school's dental clinic, treating patients. The degree of Doctor of Dental Surgery (D.D.S.) is awarded by most dental colleges. An equivalent degree, Doctor of Dental Medicine (D.M.D.) is conferred by 13 schools.

Competition is keen for admittance to dental schools. In selecting students, schools give considerable weight to college grades and amount of college education; more than half the students enrolling in dental schools have bachelor's degrees. In addition, all dental schools participate in a nationwide admission testing program, and scores earned on these tests are considered along with information gathered about the applicant through recommendations and interviews. Many State-supported dental schools also give preference to residents of their particular States.

Dentists interested in research, in teaching, or in becoming specialists must complete advanced dental programs operated by dental schools, hospitals, and other institutions of higher education. These programs last 2 to 4 years.

Dental education is very costly because of the length of time required to earn the dental degree. However, the Health Professions Educational Assistance Act of 1963, as amended, provides Federal funds for loans and scholarships of up to $2,500 a year to help needy students pursue full-time study leading to the degree.

The profession of dentistry requires both manual skills and a high level of intelligence. Dentists should have good visual memory, excellent judgment of space and shape, delicacy of touch, and a high degree of manual dexterity, as well as scientific ability. The ability to instill confidence, self-discipline, and a good business sense are helpful in achieving success in private practice.

The majority of newly qualified dentists open their own offices or purchase established practices. Some start in practice with established dentists, to gain experience and to save the money required to equip an office; others may enter residency or internship training programs in approved hospitals. Dentists entering the Armed Forces are commissioned as captains in the Army and Air Force and as lieutenants in the Navy. Graduates of recognized dental schools are eligible for Federal Civil Service positions and for commissions (equivalent to lieutenants in the Navy) in the U.S. Public Health Service.

Employment Outlook

Opportunities for dentists are expected to be very good through the 1970's. The demand for dental services is expected to increase along with an expanding population; increased awareness that regular dental care helps prevent and control dental diseases; and the development of prepayment arrangements which make it easier for people of moderate means to obtain dental service. An increasing number of needy persons are expected to receive dental care services under Medicaid programs in various States. Expanded dental research activities will require more trained personnel; dental public health programs will need qualified administrators; and dental colleges will need additional faculty members. Many dentists will continue to serve in the Armed Forces.

Improved dental hygiene and fluoridation of community water supplies may prevent some tooth and gum disorders, but such measures—by preserving teeth that might otherwise be extracted—may tend to increase rather than decrease the demand for dental care. Other new techniques, equipment, and drugs, as well as the more extensive use of dental hygienists, assistants, and laboratory technicians may permit individual dentists to care for more patients. However, these developments are not expected to offset the need for more dentists.

Newly trained dentists will be needed not only to fill new openings, but also to replace dentists who retire or die.

Despite the favorable outlook for dentists, the number of men and women who will be able to enter this field will be restricted by the present limited capacity of dental schools. However, opportunities to obtain dental training are expected to increase because of recent Federal legislation which provides Federal funds to assist in the construction of additional training facilities for dentists.

Earnings and Working Conditions

During the first year or two of practice, dentists often earn little more than the minimum needed to cover expenses, but their earnings usually rise rapidly as their practice develops. Specialists generally earn considerably more than general practitioners. The average income of dentists in 1970 was about $29,000 a year, according to limited information available. In the Federal Government, new graduates of dental schools could expect to receive starting yearly salaries, depending on college records and other qualifications, ranging from $11,905 to $14,192.

Location is one of the major factors affecting the income of dentists who open their own offices. For example, in high-income urban areas dental services are in great demand; however, a practice can be developed most quickly in small towns where new dentists easily become known and where there may be less competition with established practitioners. Although the income from practice in small towns may rise rapidly at first, over the long run the level of earnings, like the cost of living, may be lower than that in larger communities.

Most dental offices are open 5 days a week and some dentists have evening hours. Dentists usually work between 40 and 45 hours a week, although many spend more than 50 hours a week in the office. Dentists often work fewer hours as they grow older, and a considerable number continue in part-time practice well beyond the usual retirement age.

Sources of Additional Information

People wishing to practice in a given State should get the requirements for licensure from the board of dental examiners of that State. Lists of State boards and of accredited dental schools, as well as information on dentistry as a career, may be obtained from:

American Dental Association, Council on Dental Education, 211 East Chicago Ave., Chicago, Ill. 60611.

American Association of Dental Schools, 211 East Chicago Ave., Chicago, Ill. 60611.

DENTAL HYGIENISTS

(D.O.T. 078.368)

Nature of the Work

Dental hygienists work under the supervision of a dentist. They remove deposits and stains from the teeth and apply prescribed medicaments to teeth for the control of dental decay. While performing this work (oral prophylaxis), dental hygienists take and record medical and dental histories, prepare diagnostic tests for interpretation by the dentist, and chart conditions of decay and disease for diagnosis by the dentist. They take and develop dental X-ray films, sterilize instruments, and maintain patient records. They also may mix filling compounds and act as chairside assistants to dentists. Hygienists teach people the techniques of mouth care and proper diet.

Dental hygienists working in school systems promote dental health by examining children's teeth, assisting dentists in determining the dental treatment needed, and reporting their findings to parents. They also perform oral prophylaxes and give instruction on correct care and brushing of teeth. Some help to develop classroom projects or assembly programs on oral health. Dental hygienists employed by health agencies work on dental health projects or perform clinical duties. A few assist in research projects. Those having advanced training may teach in schools of dental hygiene.

Places of Employment

Approximately 16,000 dental hygienists were employed in 1970; most of them were women. Many work part time. Most were employed in private dental offices. Others worked for public health agencies, school systems, industrial plants, clinics, hospitals, and dental hygiene schools. Some worked as civilian employees of the Armed Forces.

Training and Other Qualifications

Dental hygienists must pass an examination to be licensed by the State in which they wish to practice.

In all States except Alabama, eligibility for a license is limited to graduates of accredited dental hygiene schools. In 1970, candidates in 48 States and the District of Columbia could complete part of the State licensing requirements by passing a written examination given by the National Board of Dental Examiners. Upon being licensed, a hygienist becomes a Registered Dental Hygienist (R.D.H.). In order to practice in a different State, a licensed dental hygienist must pass that State's examination.

In 1970, more than 100 schools of dental hygiene in the United States were accredited or provisionally accredited by the Council on Dental Education of the American Dental Association. Most of these schools provide a 2-year certificate or associate degree program. Some have 4-year programs leading to the bachelor's degree in dental hygiene and others offer both programs. Programs leading to a master's degree are offered in five schools.

For dental hygienists interested in practicing in a private dental office, completion of the 2-year program generally is sufficient. In order to work in research, teaching, and in public or school health programs, the completion of a 4-year program usually is required.

The minimum requirement for admission to a school of dental hygiene is graduation from high school. Several schools which offer the bachelor's degree admit students to the dental hygiene program only after they have completed 2 years of college. Many schools also require that applicants take aptitude tests conducted by the American Dental Hygienists' Association.

The curriculum at a school of dental hygiene consists of courses in the basic sciences, dental sciences, and liberal arts. These schools offer laboratory work, clinical experience, and classroom instruction in subjects such as anatomy, chemistry, histology, pathology, pharmacology, and nutrition.

Young persons planning careers as dental hygienists should enjoy working with people. The ability to put patients at ease in an uncomfortable situation is helpful. Other important qualities include personal neatness and cleanliness, manual dexterity, and good health.

Employment Outlook

Employment opportunities for dental hygienists are expected to be very good through the 1970's. Despite an anticipated rise in the number of graduates from schools of dental hygiene, the demand is expected to be greater than the number available for employment.

The demand for hygienists is expected to increase as a result of the expanding population and the growing awareness of the importance of regular dental care. Increased participation in dental prepayment plans and more group practice among dentists will result in new jobs for dental hygienists. Increasing interest in dental care programs for children also may lead to more employment opportunities in this field. In addition, a great number of job openings will be created by young women leaving their jobs for marriage and family responsibilities.

Mature women who wish to return to the field, and those who desire part-time positions, can expect to find very good opportunities for employment.

Earnings and Working Conditions

Earnings of dental hygienists are affected by the type of employer, education and experience of the individual hygienist, and the area where the job is located. Dental hygienists working in private dental offices usually are salaried employees, although some are paid a commission for work performed or a combination of salary and commission. Those employed in research, administrative, supervisory, or teaching positions generally earn higher salaries.

Salaries of dental hygienists who were graduates of 2-year training programs averaged about $6,000 to $7,000 a year in 1970; graduates of 4-year baccalaureate programs averaged $7,000 to $8,000. The annual beginning salary for a dental hygienist employed by the Federal Government was either $5,853 or $6,548 in late 1970, depending on education and experience.

Dental hygienists employed full time in private offices usually work between 35 and 40 hours a week. They may work on Saturdays or during evening hours. Some hygienists work for two or more dentists.

Although most dental hygienists are employed in clean, well-lighted offices, their work may force them to stand for long periods of time. Important health protections for persons in this occupation are regular medical checkups and strict adherence to established procedures for using X-ray equipment and for disinfection.

A paid vacation of 2 or 3 weeks is common among hygienists who work full time in dental offices. Dental hygienists employed by school systems, health agencies, and the Federal or State governments have the same hours, vacation, sick leave, retirement, and health insurance benefits as other workers in these organizations.

Sources of Additional Information

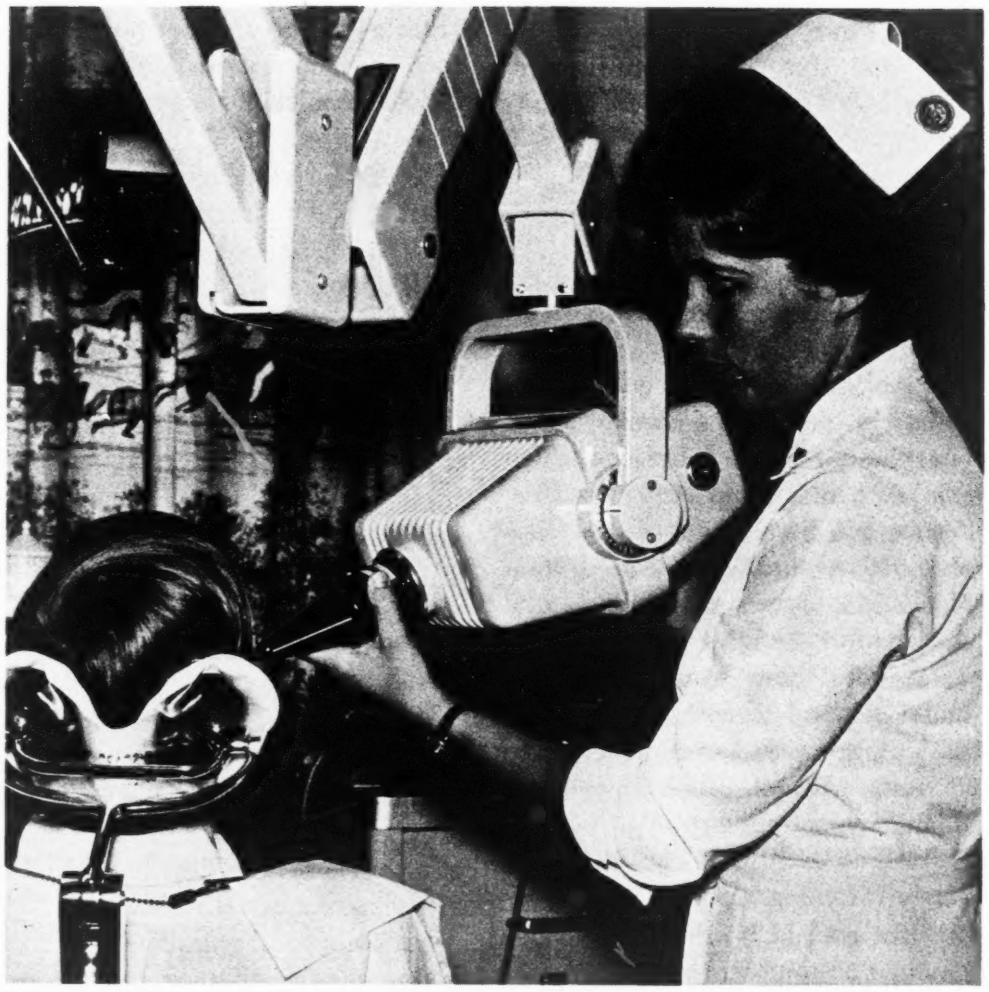
Information about approved schools and the educational requirements needed to enter this occupation may be obtained from:

Division of Educational Services,
American Dental Hygienists Association, 211 East Chicago Ave.,
Chicago, Ill. 60611.

Other material on opportunities for dental hygienists is available from:

Division of Dental Health, Public
Health Service, U.S. Department
of Health, Education, and Welfare, Washington, D.C. 20201.

Information concerning licensing requirements can be obtained from the State Board of Dental Examiners in each State, or from National Board of Dental Examiners, 211 East Chicago Ave., Chicago, Ill. 60611.



DENTAL ASSISTANTS

(D.O.T. 079.378)

Nature of the Work

Dental assistants work with dentists as they examine and treat patients. The assistant makes the patient comfortable in the dental chair, prepares him for treatment, and obtains his dental records. As the dentist works, the assistant hands the proper instruments and materials to him and keeps the patient's mouth clear by using suction or other devices. The dental assistant may prepare impression and restorative materials for the dentists' use. She also may expose and process dental X-ray film as directed by the dentist. In addition, she sterilizes and cares for dental instruments.

Although dental assistants spend most of their time at chairside, they also perform a variety of other duties. Some perform simple technical work in the office laboratory such as making casts of the teeth and mouth from impressions taken by the dentist. These casts are used to make prosthetic devices. Some manage the office, and may arrange and confirm appoints, receive patients, keep treatment records, send statements and receive payment, and order dental supplies and materials.

The work of the dental assistant should not be confused with that of the dental hygienist. Dental assistants, for instance, do not perform work in the patient's mouth, such as oral prophylaxis (scaling and cleaning the teeth); this is done by hygienists. (See statement on "Dental Hygienists.")

Places of Employment

Nearly 91,000 persons were employed as dental assistants in 1970; practically all were women. About 1 out of 6 assistants were employed part-time.

Most dental assistants worked in private dental offices, either for individual dentists or for groups of dentists. Many of the remainder were employed in dental schools, hospital dental departments, State and local public health departments, or private clinics.

The Federal Government employed about 1,850 dental assistants in 1970 chiefly in the Public Health

Service, the Veterans Administration, and the Department of the Army.

Training, Other Qualifications, and Advancement

Most dental assistants employed in 1970 learned their skill on the job. An increasing number of dental assistants, however, are entering the occupation through formal post high school dental assisting programs. About 170 such programs were accredited by the Council on Dental Education of the American Dental Association (ADA) in mid-1970. Some of these were supported under Federal legislation, including the Manpower Development and Training Act of 1962, the Vocational Education Act of 1963 and the Allied Health Professions Personnel Training Act of 1966.

Most post high school courses in dental assisting are given in junior and community colleges or in vocational or technical schools. More than two-thirds of these programs provide a full academic year of training leading to a certificate or diploma. Graduates of 2-year programs—offered only in junior and community colleges—earn an associate degree upon completion of specialized training and 1 year of liberal arts courses. A few schools provide both 1- and 2-year programs. Completion of high school or its equivalent is the standard admission requirement of all the approved schools that offer courses in dental assisting. Some schools also may require typing or a science or business course.

Approved dental assisting curriculums include instruction in both skills and related theory—in laboratory and classroom—and usually a general occupational orientation. Trainees receive practical experience in an affiliated dental school, in local clinical facilities, or in selected dental offices.

A correspondence course approved by the American Dental Association is available for employed dental assistants who are learning on the job, or who otherwise are unable to participate in regular dental assisting programs on a full-time basis. The correspondence program is equivalent to 1 academic year of study but generally requires about 2 years to complete. Some proprietary schools also offer a 4- to 6-month course in dental assisting, but these are not accredited by the dental profession.

Graduates of dental assisting programs approved by the American Dental Association, who successfully complete an examination administered by the Certifying Board of the American Dental Assistants Association and who meet certain experience requirements, may become Certified Dental Assistants. Certification is acknowledgment of an assistant's qualifications but is not a general prerequisite for employment.

After working 1 or 2 years, dental assistants sometimes seek to further their skills by becoming dental hygienists. Prospective dental assistants who forsee this possibility should plan carefully, since credit earned in a dental assistant program usually is not applicable toward requirements for a dental hygiene certificate.

Employment Outlook

Employment opportunities for dental assistants are expected to be excellent through the 1970's, especially for graduates of academic programs in dental assisting. Part-time opportunities also will be very favorable.

Growing awareness of the importance of regular dental care and the increasing ability of persons to pay for care are among the factors underlying an anticipated rapid growth in the demand for the services of dental assistants. Other factors affecting demand are an increased participation in dental prepayment plans, and the expansion of public programs such as Medicaid and Head Start, which extend dental care services to the disadvantaged. Another important factor in the growing need for more dental assistants is the slow increase in the supply of dentists in proportion to population growth, resulting in the greater use of auxiliary workers.

In addition to the rapid growth of the occupation, many assistants also will be needed each year to replace the large number of women who leave the field for marriage and family responsibilities.

Earnings and Working Conditions

Weekly salaries of assistants employed in private dental offices ranged from $75 to $150 in 1970 according to the limited data available. Salary depends largely on the assistant's education and experience, the duties and responsibilities attached to the particular job, and the part of the country in which the job is located.

In the Federal Government, experience and the amount and type of education govern entrance salaries. In 1970, a person who had 6 months' related experience started at $5,212 a year; graduates of an ADA-approved 1-year training program who had an additional year of general experience could expect to start at $5,853 a year.

Although the 40-hour workweek prevails for dental assistants, the schedule is likely to include work on Saturday. A 2- or 3-week paid vacation is common. Sick leave and other benefits are dependent on the individual dentist. Dental assistants employed by the Federal Government receive the same employee benefits as other workers.

Dental assistants generally work in a well-lighted, clean environment. They must exercise caution in handling X-ray and other equipment, where strict adherence to proper procedure is indispensable for safety.

Sources of Additional Information

Information about career opportunities; scholarships; accredited dental assistant programs, including the correspondence programs; and requirements for certification may be obtained from:

American Dental Assistants Association, 211 East Chicago Ave., Chicago, Ill. 60611.

Other material on opportunities for dental assistants is available from:

Division of Dental Health, Public Health Service, U.S. Department of Health, Education, and Welfare, Washington, D.C. 20201.

DENTAL LABORATORY TECHNICIANS

(D.O.T. 712.381)

Nature of the Work

Today, dental laboratory technicians are employed to make dentures (artificial teeth), crowns, bridges, and other dental and orthodontic appliances once made by dentists. The technicians do not see patients but follow dentists' written instruction.

In making many dental appliances, the technicians form models in artificial stone (hard plaster) from impressions of patients' mouths taken by dentists. They also make metal castings for dentures, finish and polish dentures, construct metal or porcelain crowns or inlays for partially destroyed teeth, make bridges of gold and other metals, and make appliances to correct abnormalities such as cleft palates.

In beginning jobs, trainees usually perform relatively simple tasks such as mixing and pouring plaster into casts and molds. As they gain experience, they do more difficult laboratory work. Some dental laboratory technicians do all types of dental laboratory work. Others specialize in making crowns and bridges, arranging artificial teeth on dental appliances, processing plastic materials, working with dental ceramics (porcelain), or making castings of gold or nonprecious metal alloys. In performing their work, technicians use small handtools, special electric lathes and drills, high-heat furnaces, and other kinds of specialized laboratory equipment.

Places of Employment

An estimated 33,500 dental laboratory technicians were employed in 1970. Most worked in commerical laboratories, either as employees or as owners of the business. Commercial laboratories, which handle orders from dentists, usually employ fewer than 10 technicians. However, a few large laboratories employ many technicians.

More than 7,500 dental laboratory technicians were employed full-time by individual dentists. Some worked in hospitals that provided dental services. Other were employed by the Federal Government, chiefly in Veteran's Administration hospitals and clinics and in the Department of the Army. Dental laboratory technicians also are employed by dental materials or equipment manufacturers as technical representatives or salesmen. Women, who account for about one-fifth of all full-time dental laboratory technicians, worked mainly in large commercial laboratories.

Dental laboratory technicians, like the dentists who use their services, are located mainly in cities and in States that have large populations.

Training, Other Qualifications, and Advancement

Although no minimum formal education is needed to enter this occupation, a high school diploma is an asset. Most dental laboratory technicians learn the craft on the job, usually in a commercial laboratory, a dental office, or a hospital offering dental services. Typically, on-the-job training lasts 3 or 4 years, depending on factors such as the trainee's previous experience, his ability to master the techniques, and the number of specialized areas to be learned. Courses in dental laboratory work, offered in a few public vocational high schools may be taken in conjunction with on-the-job training. Persons also may qualify by enrolling in 1- or 2-year programs in dental laboratory technology offered by junior colleges and other post-secondary educational institutions. Some of these training programs were supported by Federal legislation, including the Vocational Education Act of 1963, Manpower Development and Training Act of 1962, and the Allied Health Professions Personnel Training Act of 1966. Regardless of a student's educational background, employers consider actual work experience to be necessary for a person to qualify as a full-fledged technician.

In 1970, 2-year educational programs accredited by the American Dental Association were offered by 23 schools to high school graduates (or those with equivalent education). The first year of training in these schools includes formal classroom instruction in dental law and ethics, chemistry, ceramics, metallurgy, and other related subjects. During the second year, the student is provided supervised practical experience in the school or a dental laboratory. After completing the 2-year training program, the trainee generally needs an additional 3 years of practical experience in a dental office or a laboratory to become recognized as a well-qualified dental technician.

The National Association of Certified Dental Laboratories sponsors a certification program for dental laboratory technicians who can meet certain training and other requirements. Certification may become increasingly important for advancement as more employers regard it as evidence of the technician's competence.

Among the personal qualifications which employers look for in selecting trainees are a high degree of manual dexterity, good color perception, patience, and a liking for detailed work. Preference also may be given to young people who have completed high school courses in art, crafts, or sciences.

Employment Outlook

Job opportunities for well-qualified dental laboratory technicians are expected to be very good through the 1970's. The outlook for trainees also should be very favorable. In addition to an expected rapid increase in employment, many openings for dental laboratory technicians will occur because of the need to replace technicians who transfer to other fields of work, retire, or die.

Opportunities for salaried employment for both experienced and trainee dental laboratory technicians will be best in commercial laboratories and in the Federal Government. Some experienced technicians also should be able to establish laboratories of their own. A technician whose work has become known to several dentists in a community will have the best prospect of building a successful business.

Among the factors underlying the expected rapid growth in demand are the availability of new dental prepayment plans and the increasing number of older people requiring artificial dentures. Moreover, the number of dentists is not expected to keep pace with the demand for their services; hence, to devote more time to treatment of patients, dentists will send more and more of their laboratory work to commercial firms, or hire dental laboratory technicians to work directly for them.

Earnings and Working Conditions

Apprentice or trainee dental laboratory technicians employed in commercial laboratories in 1970 earned an average of $78 a week. Technicians having 10 years experience or more in commercial laboratories generally earned between $170 and $225 a week, depending on their skill level and experience. Ceramist technicians and crown and bridge technicians received the highest salaries. Foremen and managers in large dental laboratories may earn up to $300 per week. In general, net earnings of self-employed technicians are higher than those of salaried workers.

The starting salary for inexperienced dental laboratory technicians employed in the Federal Government was about $112 a week in 1970. Experienced dental laboratory technicians employed in the Federal Government generally earned between $166 and $195 a week.

Salaried technicians usually work the standard 40-hour week, but self-employed technicians frequently work longer hours. Many technicians in commercial laboratories receive paid holidays and vacations, and some also are provided paid sick leave, bonuses, and other fringe benefits. Technicians employed by the Federal Government have the same benefits as other Federal employees.

The work of dental laboratory technicians is not strenuous. Most jobs in the field can be performed by handicapped workers provided they have good use of their hands and fingers.

Sources of Additional Information

Information about the training and lists of approved schools are available from:

American Dental Association, Council on Dental Education, 211 East Chicago Ave., Chicago, Ill. 60611.

Information on scholarships is available through schools conducting dental technology education programs or:

The American Fund for Dental Education, 211 East Chicago Ave., Chicago, Ill. 60611.

Information on apprenticeship programs may be obtained from:

The Dental Laboratory Conference, 1918 Pine St., Philadelphia, Pa. 19103.

Information on career opportunities in commercial laboratories, and requirements for certification, may be obtained from:

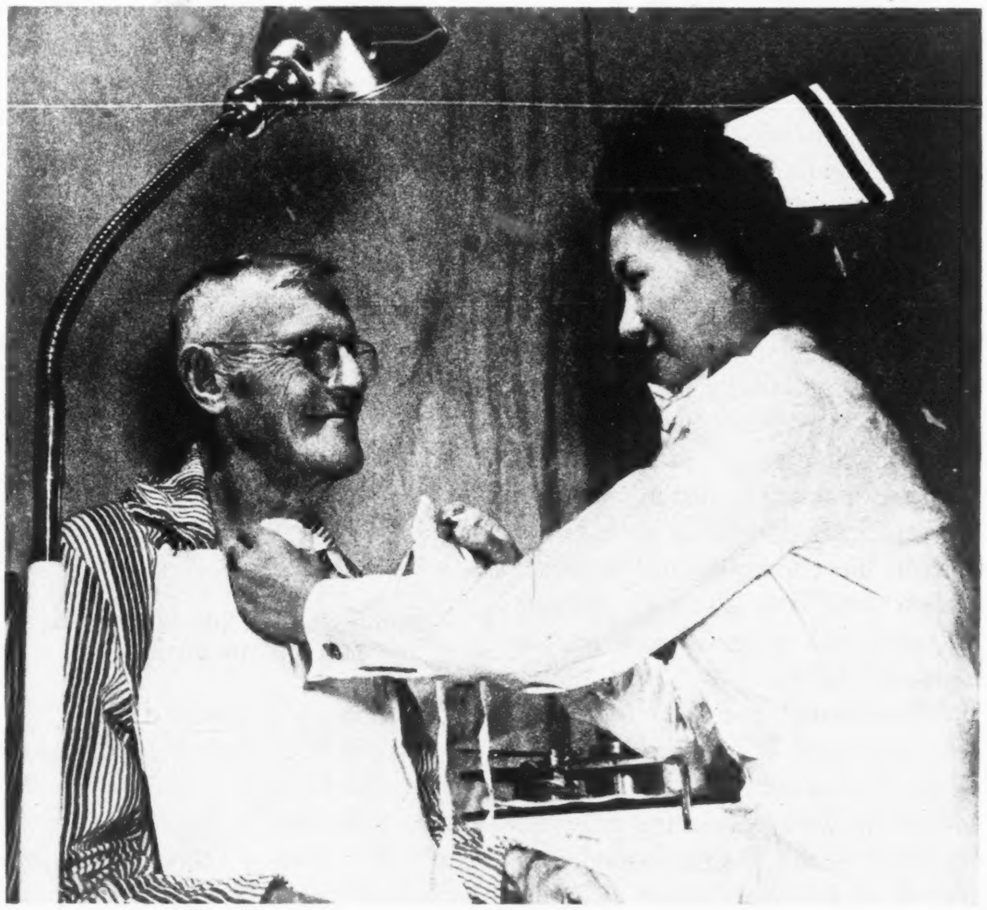
National Association of Certified Dental Laboratories, Inc., 3801 Mt. Vernon Ave., Alexandria, Va. 22305.

REGISTERED NURSES

(D.O.T. 075.118 through .378)

Nature of the Work

Nursing care plays a major role in the treatment of persons who are ill. Registered nurses, in carrying out the medical treatment plan prescribed by physicians, administer medications and treatments; observe, evaluate, and record symptoms, reactions, and progess of patients; assist in the education and rehabilitation of patients; help maintain a physical and emotional environment that promotes patient recovery; instruct auxiliary personnel or students; and perform other duties involving care of the sick and injured, prevention of illness, and promotion of good health. Nurses may also engage in research activi-



ties or serve on the staffs of nursing and community organizations.

Hospital nurses are the largest group of registered nurses. Most are staff nurses, who perform skilled bedside nursing such as caring for a patient after an operation and giving medications. They also supervise auxiliary nursing workers. Hospital nurses usually work in a specialty area such as operating or recovery room. Others work with children, the elderly, or the mentally ill. Still others are engaged primarily in administration.

Private duty nurses give individual care to patients needing constant attention. The private duty nurse may sometimes care for several hospital patients who require special care but not full-time attention.

Office nurses assist physicians, dental surgeons, and occasionally dentists in private practice or clinics. Sometimes, they perform routine laboratory and office work.

Public health nurses care for patients in clinics or visit them in their homes. Their duties include instructing patients and families, and giving periodic care as prescribed by a physician. They instruct groups of patients in proper diet and arrange for immunizations. These nurses work with community leaders, teachers, parents, and physicians in community health education. Some public health nurses work in schools.

Nurse educators teach students the principles and skills of nursing, both in the classroom and in direct patient care. They also may conduct refresher and in-service courses for registered nurses.

Occupational health or industrial nurses provide nursing care to employees in industry and government, and along with physicians promote employee health. As prescribed by a doctor, they treat minor injuries and illnesses occurring at the place of employment, provide for the needed nursing care, arrange for further medical care if necessary, and offer health counseling. They also may assist with health examinations and inoculations.

(Licensed practical nurses who also perform nursing service are discussed elsewhere in the *Handbook*.)

Places of Employment

An estimated 700,000 registered nurses were employed in the United States in 1970. More than two-thirds worked in hospitals, nursing homes, and related institutions. Approximately 60,000 were private duty nurses who cared for patients in hospitals and private homes, and about 50,000 were office nurses. Public health nurses in government agencies, schools, visiting nurse associations, and clinics numbered more than 50,000; nurse educators in nursing schools accounted for about 31,000; and occupational health nurses in industry, approximately 20,000. Most of the others were staff members of professional nurse and other organizations, State boards of nursing, or were employed by research organizations.

More than one-fourth of all nurses employed in 1970 worked on a part-time basis. About 1 percent of all employed registered nurses are men.

Training, Other Qualifications, and Advancement

A license is required to practice professional nursing in all States and in the District of Columbia. To obtain a license, a nurse must have graduated from a school approved by a State board of nursing and pass a State board examination. Nurses may be licensed in more than one State, either by examination or endorsement of a license issued by another State.

Graduation from high school is required for admission to all schools of nursing. Three types of educational programs—diploma, baccalaureate, and associate degree—offer the basic education required for careers in registered nursing. Diploma programs are conducted by hospital and independent schools and usually require 3 years of training; bachelor's degree programs usually require 4 years of study in a college or university, although a few require 5 years; associate degree programs in junior and community colleges require approximately 2 years of nursing education. In early 1970, more than 1,300 programs of these three types were offered in the United States. In addition, about 70 colleges and universities offered master's and doctoral degree programs in nursing.

Programs of nursing include classroom instruction and supervised nursing practice. Students take courses in anatomy, physiology, microbiology, nutrition, psychology, and basic nursing care. Under close supervision, in hospitals and health facilities, they receive clinical experience in caring for patients who have different types of health problems. Students in colleges offering bachelor's degree programs and in some of the other schools are assigned to public health agencies to learn how to care for patients in clinics and in the patients' homes. General education is combined with nursing education in baccalaureate and associate degree programs and in some diploma programs.

Qualified students in need of financial aid may obtain a nursing scholarship or a low-interest loan under Title II of the Health Manpower Act of 1968. Up to 50 percent of the amount of the loan may be cancelled at the rate of 10 percent for each year of full-time employment as a professional nurse in nurse training or service in any public or nonprofit institution or agency. Up to 100 percent of the loan plus interest may be cancelled at the rate of 15 percent a year for each complete year of service as a full-time professional nurse in a public or nonprofit hospital located in an area which has a substantial shortage of nurses at such hospitals. The Nurse Training Act also provides traineeship funds to cover tuition, fees, and a stipend and allowances for nurses seeking advanced training for positions as administrators, supervisors, nursing specialists, and nurse educators.

Young people planning nursing careers should have a desire to serve humanity and be sympathetic to the needs of people. Nurses must follow doctor's orders precisely and exhibit good judgment in emergencies. Good mental health is helpful in coping with human suffering and frequent emergency situations. Physical stamina may be required for staff nurses in institutions because of the amount of time spent walking and standing.

From staff positions in hospitals, experienced nurses may advance to head nurse, supervisor, assistant director, and director of nursing services. A master's degree, however, often is required for supervisory and administrative positions, as well as for positions in nursing education, clinical specialization, and research. In public health agencies, advancement is usually limited for nurses without degrees in public health nursing.

Employment Outlook

Employment opportunities for registered nurses are expected to be very good through the 1970's. For nurses who have had graduate education, the outlook is excellent for obtaining positions as administrators, teachers, clinical specialists, public health nurses, and for work in research.

The principal factors underlying the anticipated rise in the demand for nurses include a rising population; improved economic status of the population; extension of prepayment programs for hospitalization and medical care, including Medicare and Medicaid; expansion of medical services as a result of new medical techniques and drugs; and increased interest in preventive medicine and rehabilitation of the handicapped. In addition to filling new positions, large numbers will be needed to replace those who leave the field each year because of marriage and family responsibilities.

Nurses wishing to return to work will find very good employment opportunities, either full or part time.

Earnings and Working Conditions

Annual starting salaries of registered nurses employed by hospitals in 1970 averaged about $7,400, according to a national survey conducted by the University of Texas Medical Branch. Registered nurses employed in nursing homes can expect to earn slightly less than those in hospitals. Salaries of industrial nurses averaged $147 a week in early 1970, according to a survey conducted by the Bureau of Labor Statistics (BLS).

Fees for private duty nurses generally were between $26 and $44 for a basic 8-hour day in early 1970, according to the American Nurses' Association (ANA).

In 1970, the Veterans Administration offered inexperienced nurses having a diploma or an associate degree an annual salary of $7,294; baccalaureate graduates were offered $8,519. Graduates of associate degree programs having 1 year of experience or those having a baccalaureate degree or diploma entered at $6,548 in other Federal Government agencies.

Most hospital nurses receive extra pay for work on evening or night shifts. Nearly all receive at least 2 weeks of paid vacation after 1 year of service. Most hospital nurses receive from 5 to 13 paid holidays a year and also some type of health and retirement benefits.

Sources of Additional Information

Information on approved schools of nursing, nursing careers, loans, scholarships, salaries, working conditions, and employment opportunities may be obtained from:

ANA-NLN Committee on Nursing Careers, American Nurses' Association, 10 Columbus Circle, New York, N.Y. 10019.

Information about employment opportunities in the Veterans Administration is available from:

Department of Medicine and Surgery, Veterans Administration, Washington, D.C. 20420.

LICENSED PRACTICAL NURSES

(D.O.T. 079.378)

Nature of the Work

Licensed practical nurses assist in caring for persons physically or mentally ill or infirm. These include medical and surgical patients, convalescents, the handicapped, the aged, and others. Under the direction of physicians and registered nurses, they provide nursing care requiring technical knowledge but not the professional training of a registered nurse. (See statement on "Registered Nurses".) In California and Texas, licensed practical nurses are known as *licensed vocational nurses*.

In hospitals, licensed practical nurses provide much of the bedside care needed by patients, such as taking and recording temperatures and blood pressures, changing dressings, administering certain prescribed medicines, and bathing bed patients and helping them in other ways with personal hygiene.

Other duties include: Assisting physicians and registered nurses in examining patients and in carrying out complex nursing procedures; assisting in the delivery, care, and feeding of infants: and helping registered nurses in recovery rooms by reporting any adverse changes in patients. Some licensed practical nurses help in the supervision of hospital attendants. (See statement on "Hospital Attendants.")

When employed in private homes, licensed practical nurses care mainly for patients whose day-to-day care seldom involves highly technical procedures or complicated equipment. In addition to providing the nursing care ordered by physicians, they prepare patients' meals and care for patients' comfort and morale. Licensed practical nurses also teach family members how to perform simple nursing tasks.

In doctors' offices and in clinics, licensed practical nurses help physicians by preparing patients for examinations and treatments. In addition, they make appointments and record information about patients.

Places of Employment

About 370,000 licensed practical nurses were employed in 1970. The great majority were women.

About three-fifths of all licensed practical nurses were employed in hospitals. Most of the others worked in nursing homes, clinics, doctor's offices, sanitariums, and other long-term care facilities. Public health agencies and welfare and religious organizations also employed many licensed practical nurses. Some were self-employed working in hospitals or the homes of their patients.

Training, Other Qualifications, and Advancement

All States and the District of Columbia regulate the preparation and licensing of practical nurses. Usually, licenses are issued only to those who have completed a course of instruction in practical nursing which has been approved by the State board of nursing, and who also have passed a licensing examination.

Young persons seeking to enroll in State-approved training programs usually must have completed at least 2 years of high school or its equivalent. Physical examinations are required and aptitude tests given. Some States accept candidates who have completed only the eighth or ninth grade. Other States require high school graduation. Many schools that do not require completion of high school nevertheless give preference to graduates.

In 1970, about 1,250 State-approved programs provided training in practical nursing. More than one-half were offered by public schools as a part of vocational and adult education programs. Other programs were available at junior colleges, or were sponsored by local hospitals, health agencies, and private educational institutions and were usually 1 year in length. Many of the training programs receive financial assistance under the Manpower Development and Training Act and the Vocational Education Act.

Training includes both classroom study and clinical practice. Classroom instruction covers nursing concepts and principles and related subjects such as anatomy, physiology, medical-surgical nursing, administration of drugs, nutrition, first aid, and community health. This work is supplemented by laboratory practice and by supervised work in hospitals where students apply their skills to an actual nursing situation.

Applicants for the occupation of licensed practical nurse should have a deep concern for human welfare. Since working with sick and injured people can sometimes be upsetting, licensed practical nurses should be emotionally stable. They should be able to accept menial duties as part of their daily routine. Being part of a medical team, they must be able to follow orders and work under close supervision. Physical stamina also is an asset, since practical nurses must be on their feet a great deal. Good health is extremely important.

Opportunities for advancement are limited, unless workers take additional training. In-service educational programs enable some licensed practical nurses to prepare for work in specialized areas such as rehabilitation. Practical nurses cannot become registered nurses, however, unless they undertake additional schooling.

Employment Outlook

Licensed practical nurses are expected to be in strong demand during the years ahead. Employment is expected to continue to rise very rapidly through the 1970's, and a large number of new jobs will have to be filled each year as health facilities continue to expand. In addition, many workers will be needed annually to replace licensed practical nurses who retire or stop working for other reasons. Opportunities for part-time work are expected to be plentiful.

Factors contributing to increased employment are a greater need for health services because of population growth, the increasing ability of persons to pay for health care, and the continuing expansion of both public and private health insurance plans. Greater utilization of licensed practical nurses for work not requiring the skills of a registered nurse also is expected to continue to create many job opportunities.

Earnings and Working Conditions

Licensed practical nurses employed in hospitals and medical schools received average starting salaries of about $110 a week in 1970, according to a national survey conducted by the University of Texas Medical Branch.

Many hospitals give licensed practical nurses periodic pay increases after specific periods of satisfactory service. Some hospitals also provide free laundering of uniforms. A few institutions provide free lodging. The scheduled workweek is generally 40 hours but often it includes some work at night and on weekends and holidays. Paid holidays and vacations, and health insurance and pension plans are provided by many hospitals.

In private homes, licensed practical nurses usually are on duty for 8 to 12 hours a day and go home at night. A few, on 24-hour duty, live at the homes where they are employed. The basic 8-hour fee in 1969 ranged from $15 to $30, according to the American Nurses' Association.

Salaries of licensed practical nurses employed by public health agencies averaged about $5,750 a year in 1970. The beginning annual salary in the Federal Government for persons having completed a State-approved program of study in practical nursing was $5,212 in 1970.

Sources of Additional Information

A list of State-approved training programs and information about practical nursing may be obtained from:

ANA-NLN Committee on Nursing Careers, American Nurses' Association, 10 Columbus Circle, New York, N.Y. 10019.

National Association for Practical Nurse Education and Service, Inc., 535 Fifth Ave., New York, N.Y. 10017.

National Federation of Licensed Practical Nurses, Inc., 250 West 57th St., New York, N.Y. 10019.

Information about employment opportunities in U.S. Veterans Administration hospitals is available from:

Department of Medicine and Surgery, Veterans Administration, Washington, D.C. 20420.

MEDICAL ASSISTANTS

(D.O.T. 079.368)

Nature of the Work

Medical assistants help physicians examine and treat patients, as well as keep abreast of the reams of paperwork that flow in the wake of current medical treatment.

Medical assistants carry out routine tasks such as preparing patients for examination, medical treatment, and surgery. They may help examine patients by checking weight, height, temperature, blood pressure, and making simple laboratory tests. Medical assistants help in treatment by instructing patients about medication and self-treatment at home, administering injections, applying surgical dressings, and taking elec-

Medical assistant checks patient's record.

trocardiograms and X-rays, as well as sterilizing and cleaning instruments and other supplies. Medical assistants also perform a variety of clerical jobs. They keep patients' medical records, fill out medical and insurance forms, handle correspondence, schedule appointments, and act as receptionists. Other office duties include dictation, bookkeeping, billing, and receiving payments on bills. Medical assistants may also arrange instruments and equipment in the examining room, check office and laboratory supplies, and maintain the waiting, consulting and examination rooms in neat and orderly condition.

Places of Employment

An estimated 175,000 medical assistants were employed in 1970, almost all of whom were women. The large majority work in the offices of physicians in private practice. The remainder work in hospitals and medical clinics.

Training, Other Qualifications, and Advancement

Most medical assistants employed in 1970 qualified for the occupation through training received in physicians' offices. A small number were trained in on-the-job programs sponsored by the Manpower Development and Training Act (MDTA). Further information about MDTA opportunities is available from State Employment Services. Some were trained in vocational programs offered by high schools, or by vocational institutes and junior colleges. Others learned their skills in adult education courses provided by post-secondary schools.

In general, applicants for on-the-job training or for post-secondary school academic training must be high school graduates or have equivalent education. High school courses in mathematics, sciences, and office practices are desirable for students seeking admission to medical assistant programs.

Junior college programs for medical assistants are being established in increasing numbers. Most are 2-year programs, leading to an associate degree; the others are 1-year programs and graduates receive a diploma. The programs require completion of designated academic courses, as well as supervised on-the-job clinical experience. Among courses required are biology, chemistry, anatomy, and physiology; laboratory techniques and use of medical machines; medical assistant administrative and clinical procedures; medical terminology; medical office practices; reception of patients; and typing, shorthand, and accounting.

Students wishing to continue their education and obtain a bachelor's degree must realize that not all 4-year colleges accept the same type and amount of credits from different junior colleges. Therefore, it is important for students to apply for admission to a junior college in which they can complete the kind of courses and number of credits acceptable for transfer to a 4-year college.

Medical assistants who meet the standards of the American Association of Medical Assistants (AAMA) may apply for the title of Certified Medical Assistant. An applicant for certification must pass a written examination and have a high school education. She must also be employed as a medical assistant and have at least 3 years' experience in the field. An applicant who has an associate degree in medical assisting need have only one year of experience. Certification is not a license and is not required for

AAMA membership; however, Certified Medical Assistants are usually considered by physicians to be high-calibre workers.

Persons who wish to become medical assistants should be able to get along with people, since they will be required to work closely with a variety of people. They should also be thorough, accurate, dependable, and conscientious.

Employment Outlook

Opportunities for medical assistants are expected to be excellent through the 1970's, particularly for graduates of 2-year junior college programs. Rapid growth in the occupation is anticipated during the decade. Many more medical assistants will be needed to help doctors engaged in patient care because of the shortage of physicians in most areas of the country and the increasing complexity of medical practice combined with a growing volume of paper work that must be completed in doctors' offices. Other general factors expected to contribute to an increasing demand for medical assistants include those which underly the overall growth in medical care in the United States such as a rapidly growing population; an increasing number of older persons, the people most in need of medical care; improved standards of living including a growing demand for more and better health care; expanding coverage under prepayment programs which enable persons to pay for hospital and medical care; increasing expenditures by Federal, State, and local governments for health care services; and advances in medical technology which enable physicians to treat and cure more illnesses.

In addition to job openings resulting from growth of the profession, many openings will arise because of the need to replace workers who die, retire, or leave the occupation for other reasons.

Earnings and Working Conditions

In 1970, weekly salaries generally ranged from $90 to $125 for inexperienced medical assistants and from $125 to $160 for experienced assistants, according to limited information available. The salaries of beginners depended on their training and other qualifications. Junior college graduates generally received higher starting salaries than those paid workers without any training.

Medical assistants usually have a 40-hour workweek. Their hours, however, may be irregular. They may work evenings and Saturdays. If so, they receive equivalent time off during weekdays.

Sources of Additional Information

General information on a career as a medical assistant, and on the certification program, may be obtained from:

American Association of Medical Assistants, 200 East Ohio Street, Chicago, Ill. 60611.

Information on training programs for medical assistants may be obtained from:

American Medical Association, Council on Medical Education, 535 North Dearborn Street, Chicago, Ill. 60610.

SURGICAL TECHNICIANS

(D.O.T. 079.378)

Nature of the Work

Surgical technicians, also known as operating room technicians, work under the supervision of registered professional nurses in assisting surgeons and anesthesiologists.

They help prepare patients for surgery by washing, shaving, and disinfecting the parts of the body where the surgeons will operate. They may transport patients to the operating room, and help drape and position them on the operating table. Before the operation, surgical technicians also may obtain instruments, equipment, sterile linen, and fluids needed during an operation, such as blood, plasma, glucose and saline solution.

During surgery, these technicians provide valuable extra hands to aid the professional surgical team in passing instruments and other sterile supplies. They hold retractors, cut sutures, and help nurses count the

sponges, needles, and instruments used during the operation. Surgical technicians also assist in the preparation, care, and disposition of operative specimens taken for testing, and help with the application of dressings. Other duties include operating sterilizers, lights, suction machines, diagnostic equipment, and electro-surgical apparatus.

After the operation, surgical technicians help transfer patients to the recovery room and assist nurses in cleaning and stocking the operating room for the next operation.

The Manpower Development and Training Act (MDTA) also sponsors training programs for surgical technicians. Detailed information about these programs may be obtained from State Employment Services. Surgical technicians are trained also in adult education, technical, and vocational courses. The medic programs of the Armed Forces also are a training ground for surgical technicians. Currently, there are about 25 junior colleges which offer training for surgical technicians. Generally, these are 1-year courses leading to a certificate, although there are some 2-year curriculums offering an associate in arts degree.

Students in surgical technician programs at junior colleges and in vocational schools must complete classroom training as well as supervised clinical experience. Among the required courses are basic sciences such as anatomy, physiology, and microbiology. Students also have courses of practical application, such as care and safety of patients during surgery; use of anesthetic agents and avoidance of their hazards; related nursing procedures including observation of vital signs and post-operative patient care. They must also know principles of operating techniques including gowning and gloving, sterilization of instruments, and prevention of control of infection; as well as handling of special drugs, solutions, supplies, and equipment.

Places of Employment

Approximately 25,000 surgical technicians were employed in the United States in 1970; most were women. They worked in the operating room facilities of hospitals, which are located in small and large cities throughout the country. Many surgical technicians are members of the Armed Forces.

Training, Other Qualifications, and Advancement

An applicant for a surgical technician position usually must have a high school education or equivalent for admission to on-the-job training programs offered in hospitals. Some hospitals give preference to applicants who have had previous hospital work experience as attendants or practical nurses. Applicants may be required to pass aptitude tests and a physical examination. The length of training varies from 6 weeks to one year, depending on trainees' qualifications and the type of training given by the program.

Persons desiring to become surgical technicians should have manual dexterity since they must handle various instruments and operate many devices. Personal qualities considered desirable include cleanliness, orderliness, and emotional stability.

Employment Outlook

The surgical technician occupation is expected to grow rapidly during the 1970's, providing excellent job opportunities for applicants. Graduates of 2-year junior college programs should experience exceptionally high demands for their services.

Many more surgical technicians will be needed to assist in large numbers of surgical operations that will necessarily accompany the country's expanding population. More surgical technicians will be required to perform an increasing amount of lower level nursing tasks, thereby enabling operating room nurses to concentrate on the duties requiring their professional knowledge. Other general factors expected to contribute to an increasing demand for surgical technicians include those which underly the overall growth in medical care in the United States, such as improved standards of living; growing health consciousness; expanding coverage under prepayment programs for hospitalization and medical care; and increasing expenditures by Federal, State, and local governments for health care services.

In addition to job openings resulting from growth of the occupation, many new surgical technicians will be needed to replace workers who die, retire, or leave the field for other reasons.

Earnings and Working Conditions

In 1970, weekly salaries generally ranged from $75 to $140 for inexperienced surgical technicians, depending on their training and other qualifications, according to limited information available. Junior college graduates received higher starting salaries than those paid workers without any training for the occupation. Weekly salaries for experienced technicians ranged from about $95 to $180.

The working hours of surgical technicians are usually 8 hours a day, 5 days a week. In addition, the technicians may be required to work "on call" shifts, for which they receive compensation.

Sources of Additional Information

Additional information on a career as a surgical technician and on programs offering training for the occupation may be obtained from:

Association of Operating Room Technicians, Inc., 8085 East Prentice, The Denver Technological Center, Englewood, Colo. 80110.

EEG TECHNICIANS

(D.O.T. 079.368)

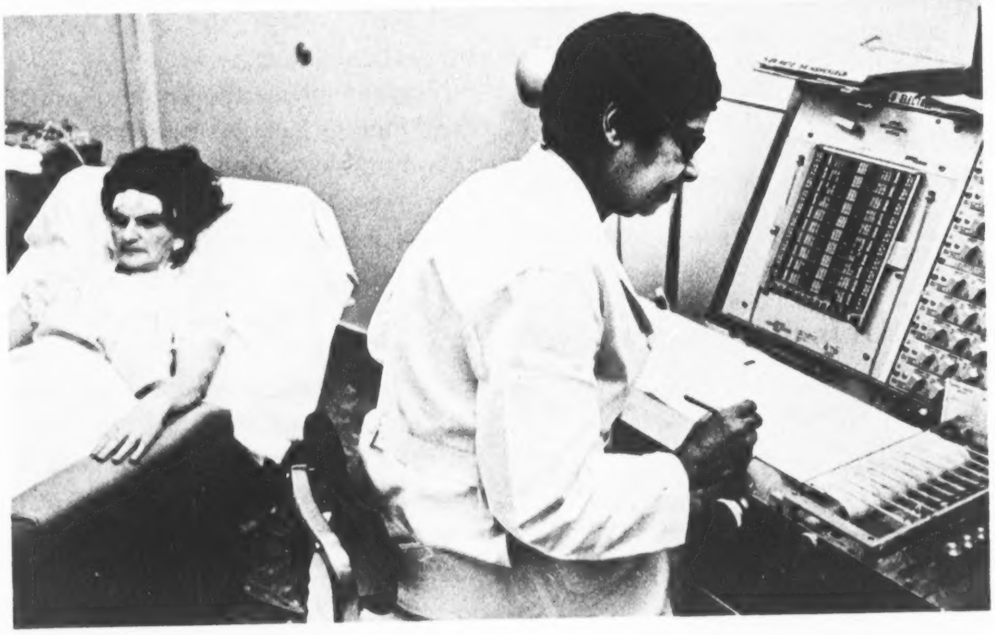
Nature of the Work

EEG (electroencephalographic) technicians fulfill an important function in diagnosing brain disease and infections through electroencephalography—a system of mechanically detecting and recording the electrical activity of the brain.

The EEG technician attaches to the patient's head electrodes leading to the electroencephalography machine that graphs (EEG's) the brain's electrical currents. The complex machine detects the electrical activity of the patient's brain; it does not emit any current of its own —a safe, painless procedure. Professional EEG personnel and neurologists interpret the electroencephalograms. However, the EEG technician must have some knowledge of medicine, anatomy, and physiology to understand the condition of the subject.

EEG's are particularly useful in diagnosing epilepsy and brain tumors, and in assessing damage and recovery after cerebral vascular strokes. EEG's have proved essential to the prognosis of patients who are in a coma. Because of its usefulness in pinpointing the time body functions stop, the recent rise in vital organ transplants has elevated the importance of EEG.

EEG technicians make simple repairs and replacements to keep equipment in good working order. They also schedule appointments and record services performed for patients.



Places of Employment

An estimated 3,000 electroencephalograph technicians were employed in 1970. EEG technicians, who are mostly women, work primarily in the neurology departments of hospitals. Some are employed in neurologist's offices; some have responsible positions in research units.

Training, Other Qualifications, and Advancement

The principal way to enter the occupation is by on-the-job training, which generally lasts from 3 to 6 months and is conducted by a neurologist or electroencephalographer and a senior technician. The minimum requirement for entrance into an on-the-job training program generally is high school graduation with science courses preferred.

Some technicians also qualify for their job through formal academic training. In 1970, 15 formal programs were offered in colleges, universities, and hospitals. These programs vary in length from 3 months to 1 year, and generally include courses in electronics, nervous system, physiology, first-aid, computer technology (to an increasing degree), and anatomy. Some of the schools require 2 years of college for entrance into the program; others require only high school.

EEG technicians who meet certain experience requirements and successfully complete a written and oral examination administered by the American Board of Registration of Electroencephalograph Technicians (ABRET) may become registered. Although not a general prerequisite for employment, registration by ABRET is acknowledgment of a technician's qualifications and will make better-paying positions easier to obtain.

As openings occur, some EEG technicians in large hospitals may advance to chief EEG technician and have larger responsibilities in laboratory management and in teaching basic techniques to new personnel. Chief EEG technicians are supervised by an electroencephalographer (a doctor specializing in the reading of EEG tracings) or a neurologist or neurosurgeon.

Manual dexterity, good vision, an aptitude for working with electronic equipment, and the ability to work with patients and other members of the hospital team are desirable personal characteristics.

Employment Outlook

Employment opportunities for EEG technicians are expected to be excellent through the 1970's. Among the principal factors underlying this demand are increased use in the diagnosis of brain diseases, and in monitoring patients; ability to determine the exact time of body function stoppage in the donor for transplant operations; and the usual factors contributing to the overall increase in health services, such as expanding population and rising living standards.

In addition to openings that will result from the rapid growth of the occupation, many will arise because of the need to replace the large number of young women who leave the field for marriage and family responsibilities.

Earnings and Working Conditions

The average monthly starting salary of EEG technicians working in hospitals in 1970 was about $455, and $470 in medical schools, according to the *National Survey of Hospital and Medical School Salaries.* Top salaries of EEG technicians ranged as high as $750 a month. Very highly qualified technicians may earn more in special training situations. Depending on general experience, the annual beginning salary for EEG technicians employed by the Federal Government was between $4,125 and $5,212 in 1970. Technicians in the Federal Government can earn as much as $9,881 a year.

EEG technicians in hospitals receive the same benefits as other hospital personnel, including hospitalization, vacation, and sick leave. Some institutions may provide tuition assistance or free courses, pension programs, uniforms, and parking.

EEG technicians generally work a 40-hour week with little after hours or Saturday work involved. The fact that a neurologist is needed to read and interpret a tracing minimizes the necessity of emergency-call duty.

Sources of Additional Information

Information about employment opportunities may be obtained from local hospitals. Additional information about the work of EEG technicians may also be obtained from:

American Hospital Association, 840 North Lake Shore Drive, Chicago, Illinois 60611.

For information on registration:

American Board of Registration of Electroencephalographic Technologists, Dr. Charles E. Henry, Cleveland Clinic, 2020 East 93rd Street, Cleveland, Ohio 44106.

EKG TECHNICIANS

(D.O.T. 078.368)

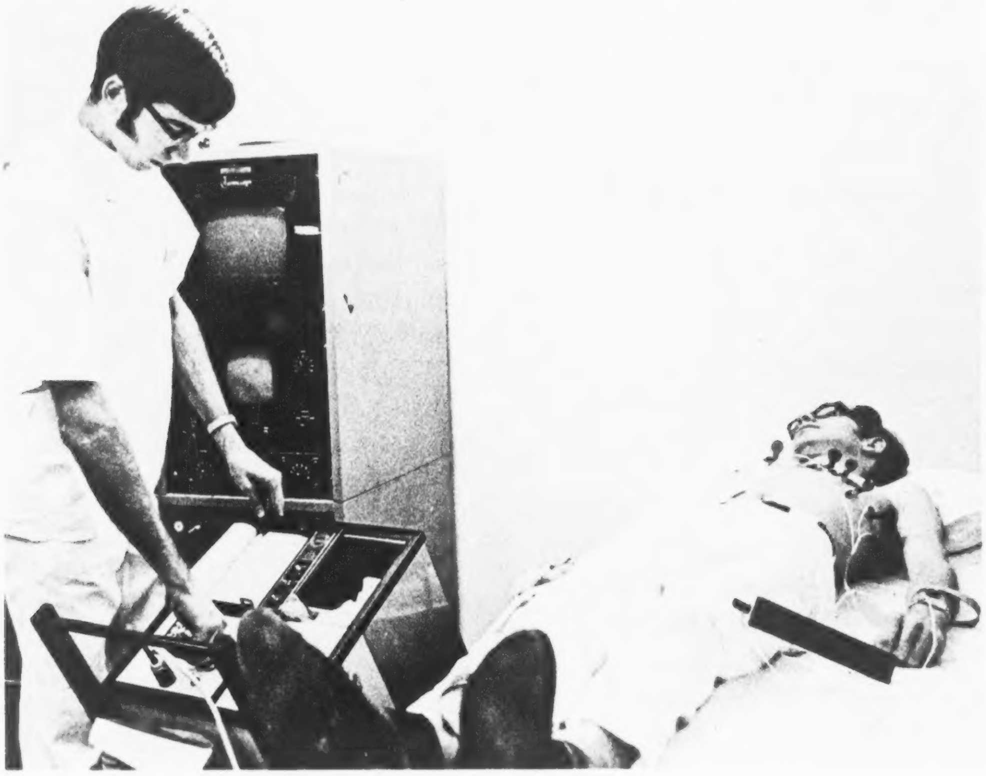
Nature of the Work

Electrocardiograms (EKG's) are pictures of a heart beat—tracings in the form of a graph produced by an instrument called an electrocardiograph. These tracings record the electronic variations in the action of the heart muscle. Physicians use electrocardiograms to diagnose irregularities in heart action and to analyze changes in the condition of a patient's heart over a period time. Some physicians order electrocardiograms as a routine diagnostic procedure for people who have reached a specified age. In some cases, the tests also are used if surgery is to be performed.

Electrocardiograph (EKG) technicians take and process electrocardiograms at the request of a physician. This is done usually at the patient's bedside, since the equipment is mobile. In taking an electrocardiogram, the technician straps electrodes to specified parts of the patient's body, manipulates selector switches of the electrocardiograph, and moves chest electrodes across the patient's chest.

The electrocardiograph records the "picture" of the patient's heart action on a continuous roll of paper. The technician clips and mounts this electrocardiogram for analysis by a physician, usually a cardiologist or heart specialist.

When technicians are taking electrocardiograms, they must be able to recognize and correct any technical errors or interferences recorded on the electrocardiograms. They also must be able to recognize any significant deviations from the norm that call for a doctor's attention.



The technician must know how to conduct EKG exercises. In these, patients exercise slightly by walking up and down a few steps and undergo EKG tests before and after the exercise. Basal metabolism tests must also be performed. These energy-measuring tests are given to patients after a period of fasting and rest. EKG technicians must be able to make photocardiograms, which record the sounds of the heart valves and blood passing through them. In addition, technicians usually schedule appointments, type doctors' diagnoses, maintain patients' EKG files, and take care of equipment.

Places of Employment

An estimated 9,500 electrocardiograph technicians were employed in 1970; most were women. Most EKG technicians were employed in cardiology departments of large hospitals. Others worked part-time in small general hospitals where workloads are usually not great enough to demand full-time technicians. Some were employed full- or part-time in clinics and doctors' offices.

Training, Other Qualifications, and Advancement

On-the-job training is the principal method of obtaining the skills of the EKG technician. Training—which may last as long as 3 months—is usually conducted by a senior EKG technician or a cardiologist. Generally, the minimum requirement for the job is high school graduation. Typing and familiarity with medical terminology are helpful.

A few colleges and universities affiliated with hospials offer EKG courses lasting a few months. The military services also provide some general training in electrocardiology. In addition, manufacturers of electrocardiographs generally provide instructions in the operation of their equipment.

In larger hospitals, EKG technicians occasionally are promoted to positions as supervisors of other EKG technicians. Advancement to jobs as junior vascular-cardio technicians is also possible in some instances. To be eligible for supervisory or other higher positions, training may be necessary in areas such as biomedical electronics. Generally, however, the number of paths to higher positions are relatively few and opportunities for advancement are limited.

Among characteristics desirable for an EKG technician's job are mechanical aptitude, the ability to follow detailed instructions and react quickly to orders and to the requirements of emergency situations; and common sense, reliability, consideration, and patience.

Employment Outlook

Employment opportunities for EKG technicians are expected to be excellent through the 1970's. The expected increase in demand is the result of increasing reliance by physicians upon electrocardiograms in the diagnosis of heart diseases and the greater use of electrocardiograph in continuous "monitoring" of patients under intensive care. Another factor contributing to the expected growth of this occupation is the general increase in demand for health services. Underlying this trend is the country's expanding population, rising living standards and improved health consciousness, extension of prepayment programs for medical care, expanding medical services resulting from new medical techniques and drugs, and expanding medical research activities.

In addition to openings resulting from growth in the occupation, vacancies will develop each year as young women leave the field for marriage and family responsibilities.

Earnings and Working Conditions

The average monthly starting salary of EKG technicians working in hospitals in 1970 was about $407, according to the *National Survey of Hospital and Medical School Salaries,* conducted by the University of Texas Medical Branch. Top salaries, in some cases, were as high as $950 a month.

The annual beginning salary for EKG technicians employed by the Federal Government was between $4,125 and $5,212 in 1970, depending on experience; a few experienced technicians earned as much as $8,956 a year.

EKG technicians working in hospitals receive the same fringe benefits as other hospital personnel, including hospitalization, vacation, and sick leave. Some institutions provide tuition assistance or free courses, pension programs, and uniforms. Technicians generally work a 40-hour week, which may include work on Saturdays.

Sources of Additional Information

Information about employment opportunities may be obtained from local hospitals. Additional information about the work of EKG technicians is also available from:

American Hospital Association, 840 North Lake Shore Drive, Chicago, Illinois 60611.

INHALATION THERAPISTS

(D.O.T. 079.368)

Nature of the Work

Inhalation therapists treat patients with respiratory problems. This may range from giving relief to patients with chronic asthma or emphysema to giving emergency care in cases of heart failure, stroke, drowning, and shock.

A rapidly evolving field, inhalation therapy requires specially trained personnel to master the use of sophisticated equipment needed in treating many respiratory problems. The inhalation therapist is one of the first medical specialists called in for emergency treatment of acute respiratory conditions arising from head injury or drug poisoning. Moreover, the short span of time during which a patient can safely cease to breathe emphasizes the highly responsible role the inhalation therapist must play. If a patient does not breathe for three to five minutes, there is little chance of recovery without brain damage, and if oxygen is cut for 9 minutes he will die.

Inhalation therapists follow doctor's orders in giving medication to the patient through aerosols or using mists to help control the patient's environment. When administering gases to patients, the inhalation therapist assumes complete control over the patient's environ-

ment, including moisture and temperature.

Inhalation therapists may also be called upon to instruct physicians and nurses on the use of specialized inhalation equipment, and show patients and their families the proper use of home equipment. Other duties include keeping records of the cost of materials and charges to patients. Therapists are responsible for routine maintenance of their equipment.

Places of Employment

An estimated 10,000 inhalation therapists were employed in 1970. Most were employed in anesthesiology or pulmonary medicine departments of hospitals. Others were employed by oxygen equipment rental companies, ambulance services, nursing homes, and universities. Most therapists are men. However, an increasing number of women are entering the field. This is due, in part, to the installation of piped-in oxygen in hospitals, eliminating the need to handle heavy cylinders of gas.

Training, Other Qualifications, and Advancement

Most therapists who entered the job before the mid-1960's qualified for their job through on-the-job training. Such training generally lasts about 1 year and is conducted by the chief therapist and medical supervisor. High school graduation generally is the minimum entry requirement.

Despite the predominance of on-the-job training in the late 1960's, the trend today is toward formalized accredited training. In 1970, over 70 schools approved by the Joint Review Committee for Inhalation Therapy Education trained inhalation therapists. Courses vary in length between 18 months and 4 years and include both theory and clinical work. A bachelor's degree is awarded for completion of 4-year programs and lesser degrees are awarded for shorter courses. Basic courses are human anatomy and physiology, chemistry, physics, microbiology, and mathematics. Technical courses offered deal with procedures, equipment, and tests.

Inhalation therapists who complete formal training and 1 year of experience are eligible to be registered by the American Registry of Inhalation Therapists (ARIT). Applicants must pass oral and written examinations. In 1970, nearly 1,300 therapists had been registered. A registered inhalation therapist often can advance faster and obtain a higher position than one who is not registered. An increasing number of employers recognize registration as an acknowledgment of the therapists' qualifications.

Inhalation therapists who do not qualify or fail to pass the registry examination, may elect to take an examination to become certified inhalation therapists. To be eligible for the certification tests, an applicant must have a high school education or the equivalent, and 2 years of experience in inhalation therapy under medical supervision; or be a graduate of an inhalation therapy training program which follows the essentials for certification, plus 1 year of experience in inhalation therapy under medical supervision; or be a graduate of an Associate Degree inhalation therapy program approved by the Joint Review Committee For Inhalation Therapy Education.

Inhalation therapists can advance to positions as assistant chief, chief therapist, or instructor of inhalation therapy at the university level.

Young persons planning careers in inhalation therapy should have the ability to work with patients and understand their physical and psychological needs. Inhalation therapists must be able to pay attention to detail and follow instructions. Mechanical ability is also a necessary attribute.

Employment Outlook

Employment opportunities for inhalation therapists are expected to be excellent through the 1970's. Those completing formal training will be in demand to fill high level supervisory positions. In the future, employment of inhalation therapists is expected to increase due to the increasing demand for health services in general. The expected rapid growth will also stem from realization that among benefits arising from employing specialists in inhalation therapy is that nurses and other personnel are released to perform their primary duties.

In addition to openings that will result from the rapid growth of the occupation, many openings will arise because of the need to replace those who retire, die, or leave the labor force for other reasons.

Earnings and Working Conditions

The average monthly starting salary of inhalation therapists working in hospitals in 1970 was about $555, according to the *National Survey of Hospital and Medical School Salaries,* conducted by the University of Texas Medical Branch. Top salaries of inhalation therapists in hospitals ranged as high as $830 a month.

The annual beginning salary for

inhalation therapists employed by the Federal Government was between $4,125 and $5,212 in 1970, depending on general experience. Some therapists employed by the Federal Government in 1970 earned as much as $9,881.

Inhalation therapists working in hospitals receive the same benefits as other hospital personnel, including hospitalization, paid vacations, and sick leave. Some institutions may provide tuition assistance or free courses, pension programs, uniforms, and parking.

Therapists generally work a 40-hour week. After-hour and weekend duty is generally required since most hospitals have 24-hour coverage throughout the week. Adherence to safety precautions and proper testing of equipment minimize hazards to therapists and patients. Safety precautions include keeping sources of ignition and electrical appliances away from respiratory apparatus and elimination of oil and alcohol rubs.

Sources of Additional Information

Information concerning employment is obtainable from local hospitals. Facts are also available from:

American Association for Inhalation Therapy, 3554 9th Street, Riverside, California 92501.

Information concerning requirements and equivalents of formal education needed for registration may be obtained from:

Executive Director, American Registry of Inhalation Therapists, 260 Crittenden Boulevard, Rochester, New York 14620.

OPTOMETRISTS

(D.O.T. 079.108)

Nature of the Work

Optometrists help patients improve and protect their vision. They make tests to determine vision problems and the presence of eye diseases and other abnormal conditions. When necessary, they prescribe vision aids including regular and contact lenses; telescopic and microscopic lenses or other high magnification aids; corrective eye exercises; and other optical treatment that does not require drugs or surgery. Most optometrists supply the eyeglasses prescribed; they sometimes also do minor repair work such as straightening eyeglass frames. Some optometrists specialize in treating the vision problems of different categories of patients such as children, older patients, and partially sighted persons; other optometric specialists are concerned with the effect of industrial and environmental factors on the visual efficiency of workers. A few optometrists are engaged in teaching, research, or a combination of both.

Optometrists should not be confused with either ophthalmologists, sometimes referred to as oculists, or with dispensing opticians. Ophthalmologists are physicians who specialize in eye diseases and injuries, perform eye surgery, and prescribe drugs or other treatment, as well as lenses. Dispensing opticians fit and adjust eyeglasses according to prescriptions written by ophthalmologists or optometrists; they do not examine eyes or prescribe treatment. (See statement on Dispensing Opticians.)

Places of Employment

Approximately 18,000 optometrists were in practice in 1970; about 2 percent were women. More than four-fifths of the optometrists were self-employed; of these, most were in solo practice and the others were in partnerships or in group practices.

Several hundred optometrists served in the Armed Forces. The remainder were salaried employees who taught in colleges of optometry or worked for established practitioners, health clinics, hospitals, optical instrument manufacturers, and government agencies.

About 4 out of 10 optometrists are located in five States—California, New York, Illinois, Pennsylvania, and Ohio. Many small towns and rural areas, especially in the South, have no optometrists.

Training, Other Qualifications, and Advancement

A license is required to practice optometry in each State and in the District of Columbia. Reciprocity agreements among some States allow an optometrist licensed in one State to practice in another.

Applicants for licenses must be graduates of an accredited school of optometry and pass the State Board examination of the State in which they will practice. In some cases, applicants are permitted to substitute the National Board of Optometry examination for the written State examination. In 1970, there were 11 schools of optometry in the United States.

Applicants having the necessary qualifications have an excellent chance for admission to these schools. To pursue full-time study leading to a degree in optometry, needy students may obtain loans and scholarships up to $2,500 a year from Federal funds provided by the Health Professions Educational Assistance Act of 1963, as amended.

At least 6 years of college are needed to become an optometrist —2 years of preoptometry education in an approved college, followed by 4 years of training in an optometry school. In addition to the degree, Delaware and Rhode Island require a 6-month internship to qualify for a license, and Mississippi, 1 year of experience.

Preoptometry courses include mathematics, physics, biology, and chemistry, as well as English and other liberal arts courses. Students in schools of optometry have classroom and laboratory work and obtain professional experience in the out-patient clinics operated by the schools. All schools of optometry award the degree of Doctor of Optometry (O.D.). Optometrists who wish to specialize often take graduate training. A master's or Ph. D. degree in physiological optics or in a related field is usually required for teaching and research work.

Since most optometrists are self-employed, business ability, self-discipline, and the ability to deal with patients tactfully are necessary for success in this field. Manual dexterity and a mechanical aptitude also are important to the optometrist since he must work with precision equipment and occasionally make repairs.

Many beginning optometrists either set up a new practice or purchase an established one. Some, on the other hand, take salaried positions to obtain experience and the necessary funds to enter their own practice.

Employment Outlook

Employment opportunities for new optometry graduates are expected to be favorable through the 1970's. Some expansion in the seating capacity of optometry schools is anticipated as a result of Federal assistance. As a result, by the middle 1970's the number of new graduates may approximate the annual number needed for growth of the occupation as well as for replacement of those who retire, die, or stop practicing for other reasons.

Among the factors underlying the expected increase in demand for eye care services are, on the one hand, growing numbers of persons in groups most likely to need glasses —older people and white-collar workers—and, on the other, increased recognition of the importance of good vision for efficiency at work and in school. Although expanded demand will be met in part by ophthalmologists, optometrists will continue to supply a substantial proportion of all eye care services.

Optometrists usually locate in heavily populated business areas. However, opportunities to establish a new practice generally will be best in small towns and in residential areas of cities, where the new optometrist can become known easily. Many communities, especially in the South, that now have no optometric services available also will offer opportunities for new graduates. A good office location is of major importance for a successful practice. The optometrist should consider the number of optometrists and ophthalmologists in the vicinity in relation to the size, occupations, age, and income level of the population in the area.

Earnings and Working Conditions

New optometry graduates who begin as solo practitioners generally have a low income during the first few years. They usually earn less than new optometrists who take salaried positions. After a few years of experience, the situation is usually reversed, since the income of independent practitioners generally exceeds the earnings of salaried optometrists.

In 1970, starting salaries of new optometry graduates ranged from about $10,000 to $12,000 a year, according to the limited information available. The average net income of experienced optometrists was about $25,000. Incomes varied greatly, depending on location, specialization, and other factors.

Most optometrists work 40 hours a week. They may occasionally work a few hours on Saturday. Since the work is not strenuous, optometrists can often continue to practice after the normal retirement age.

Sources of Additional Information

Additional information on optometry as a career is available from:

American Optometric Association,
7000 Chippewa St., St. Louis, Mo.
63119.

Information on required preoptometry courses may be obtained by writing to the optometry school in which the prospective student wishes to enroll. The Board of Optometry in the capital of the State in which the student plans to practice will provide a list of optometry schools approved by that State, as well as licensing requirements.

OPTOMETRIC ASSISTANTS

(No D.O.T. Number)

Nature of the Work

Optometric assistants perform a gamut of tasks from assisting in eye examinations to bookkeeping to allow optometrists to devote more time to their professional duties.

They prepare patients for eye examinations and help optometrists test for near and distant eyesight, color blindness, and tension or pressure of the eyeball. Optometric assistants measure patients for pupillary distance and bridge width. They suggest size and shape of eye glass frames complimentary to the patient's facial features, and adjust the finished eyeglasses by heating, shaping, and bending the plastic or metal frames. They also assist the optometrist in fitting contact lenses and in giving instructions on the use and care of the lenses.

Optometric assistants help optometrists in vision training routines for patients with focusing defects, such as teaching them to move and coordinate both eyes.

In addition to caring for patients, optometric assistants work in the laboratory. They modify conventional glasses or contact lenses to assure proper fit. They cut and insert lenses in frames, repair frames, keep an inventory of optometric materials, and clean and care for the instruments.

Optometric assistants keep patients' records, schedule appointments, and handle bookkeeping, correspondence, and filing.

Places of Employment

An estimated 5,000 optometric assistants, most of them women, were employed in the United States in 1970. Most worked for professional optometrists in private practice. Others worked for health clinics, optical instrument manufacturers, or government agencies. Some served as assistants to optometrists in the Armed Forces.

Optometric assistants work mainly in the more densely populated areas of the country.

Training, Other Qualifications, and Advancement

Most optometric assistants are trained on the job in their employers' offices. Some complete vocational or technical school courses giving them skills needed for the occupation. In 1970, 6 schools—were training students as optometric assistants. The requirements for ad-

Optometric assistant conducts a focusing defect exercise.

mission generally consisted of high school graduation or equivalent education, including some high school courses in mathematics and office procedures.

All programs contained specialized courses such as the anatomy and physiology of the human eye; orthoptics (correction of defective vision); testing color vision and visual fields; use of the tonometer (a device used in detecting glaucoma); administering corrective eye exercises and training; measuring, preparing, and fitting lenses; verifying prescriptions; selecting eyeglass frames; cutting, edging and mounting lenses; adjusting eyewear for comfort and for optical reasons; and repairing frames. Courses were also given in secretarial and office procedures. Course programs included clinical practice, under the direct supervision of an optometrist, consisting of on-the-job experience. Graduates of 2-year community college programs can advance to the position of optometric technician.

Manual dexterity, accuracy, and the ability to distinguish shades of color are important requisites for persons planning to become optometric assistants. Because of the person-to-person work relationship between optometric assistants and patients, neat appearance, courtesy, and tact are important qualifications.

Employment Outlook

A moderate increase is expected in the employment of optometric assistants through the 1970's. Assistants will be needed to fill new openings resulting from anticipated growth in employment as well as to replace workers who die, retire, or transfer to other occupations.

Most job openings will be in industrial areas located in urban and suburban regions, where professional optometrists develop practices large enough to utilize assistants.

The factors underlying a growing demand for eye care services, including those performed by optometric assistants, are similar to the factors affecting the demand for professional optometrists. These factors include: an expanding population having larger numbers of older people and white-collar workers (the groups most likely to need glasses); and a wider recognition of the importance of good vision for efficiency at work and in school.

Earnings and Working Conditions

In 1970, salaries generally ranged from $80 to $100 a week for inexperienced optometric assistants and from $125 to $160 a week for experienced workers, according to limited information available. Earnings were highest in the East and lowest in the South. Earnings varied not only by geographical region, but also by the academic and technical qualifications of optometric assistants, as well as the specializations of the optometrists employing them.

Most optometric assistants, like their employers, work 40 hours a week. Occasionally they may work a few hours on Saturday. The work is not strenuous and the physical surroundings are usually pleasant.

Sources of Additional Information

Further information on a career as optometric assistant is available from:

American Optometric Association,
7000 Chippewa Street, St. Louis,
Mo. 63119.

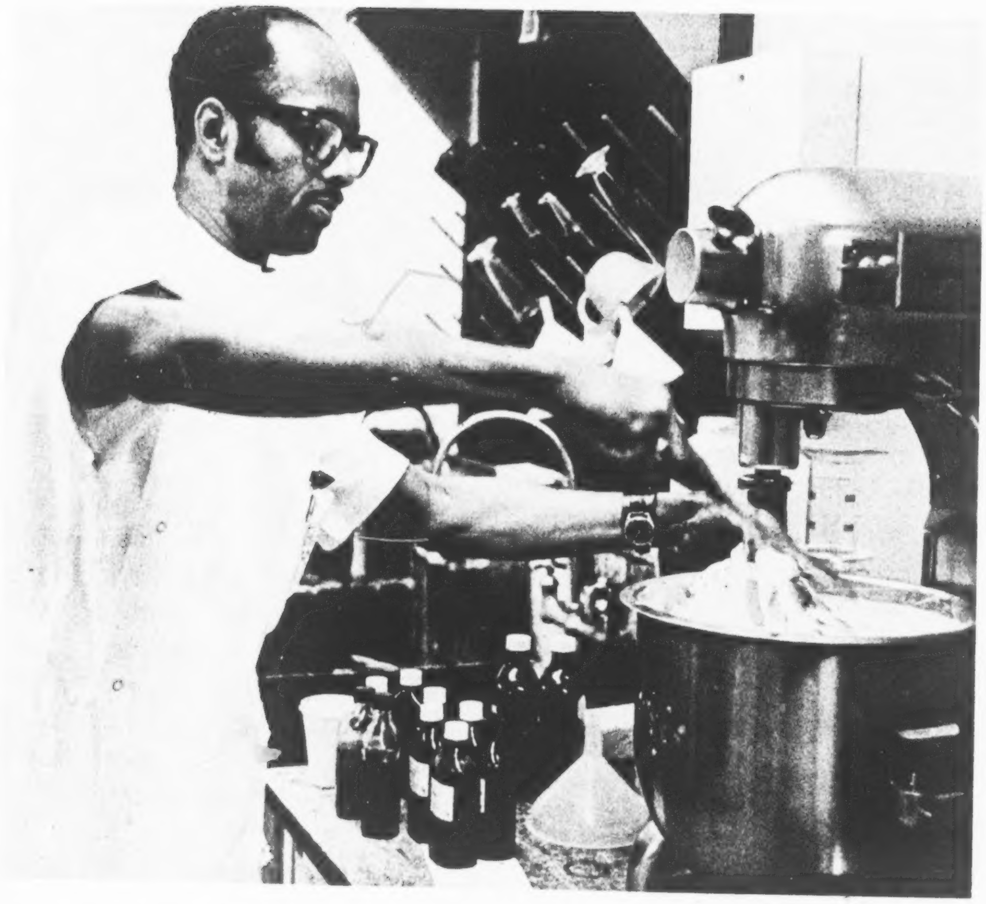
PHARMACISTS

(D.O.T. 074.181)

Nature of the Work

Pharmacists dispense drugs and medicines prescribed by medical practitioners, and supply and advise people on the use of many medicines that can be obtained without prescriptions. Pharmacists must understand the use, composition, and effect of drugs and be able to test them for purity and strength. Compounding—the actual mixing of ingredients to form powders, tablets, capsules, ointments, and solutions—is only a small part of pharmacists' work, since many drugs now are produced by manufacturers in the form used by the patient.

Many pharmacists in drugstores or community pharmacies also have other duties. Besides dispensing drugs, these pharmacists buy and sell nonpharmaceutical merchandise, hire and supervise store personnel, and oversee the general operation of the store. Some pharmacists, however, operate prescription pharmacies that dispense only drugs, medical supplies, and health accessories. Pharmacists in hospitals dispense prescriptions and advise the medical staff on the selection and effects of drugs; they also make sterile solutions, buy medical supplies, teach in schools of nursing, and perform administrative duties. An increasing number of hospital pharmacists work in patient care areas as active members of the medical team. Some pharmacists, employed as medical sales representatives or "detail men" by drug manufacturers and wholesalers, sell medicines to retail pharmacies and to hospitals, and inform practicing



Pharmacist mixes ointment.

pharmacists, doctors, dentists, and nurses about new drugs. Others teach in pharmacy colleges, do research, supervise the manufacture of pharmaceuticals, develop new drugs, edit or write articles for pharmaceutical journals, or do administrative work.

Places of Employment

Of the nearly 129,000 licensed pharmacists working in 1970, about 107,000 were in retail pharmacies. Of these retail pharmacists, almost half had their own pharmacies or owned them in partnership; the others were salaried employees. Most of the remaining salaried pharmacists were employed by hospitals, pharmaceutical manufacturers, and wholesalers. Some were civilian employees of the Federal Government, working chiefly in hospitals and clinics of the Veterans Administration and the U.S. Public Health Service. Others served as pharmacists in the Armed Forces, taught in colleges of pharmacy, or worked for State and local government agencies.

Nearly every town has at least one drugstore with one or more pharmacists in attendance. Most pharmacists, however, practice in or near cities, and in those States which have the greatest populations.

Women, who represent nearly 9 percent of all pharmacists, are employed in all branches of the profession.

Training, Other Qualifications, and Advancement

A license to practice pharmacy is required in all States and the District of Columbia. To obtain a license, one must be a graduate of an accredited pharmacy college, pass a State Board examination and, in almost all States, also have a State prescribed amount of practical experience or internship under the supervision of a licensed pharmacist. All States except California, Florida, and Hawaii grant a license without examination to qualified pharmacists already licensed by another State.

In 1970, there were 74 accredited colleges of pharmacy in the United States. Some of these were not filled to capacity and qualified applicants usually could expect to be accepted. Needy students may obtain loans or scholarships up to $2,500 a year to pursue full-time study leading to a degree in pharmacy from Federal funds provided by the Health Professions Educational Assistance Act of 1963, as amended. Several scholarships are awarded annually by drug manufacturers, chain drug stores, corporations, and State and National pharmacy associations.

To graduate from a college of pharmacy and receive a Bachelor of Science (B.S.) or a Bachelor of Pharmacy (B. Pharm.) degree, one must have at least 5 years of study beyond high school. A few colleges that require 6 years award a Doctor of Pharmacy (Pharm. D.) degree at the completion of the program. A few colleges admit students directly from high school and offer all the education necessary for graduation. Most colleges provide 3 or 4 years of professional instruction and require all entrants to have completed their prepharmacy education in an accredited junior college, college, or university. A prepharmacy curriculum usually emphasizes mathematics and basic sciences, such as chemistry and biology, but also includes courses in the humanities and social sciences. Because entry requirements vary among colleges of pharmacy, prepharmacy students should ascertain and follow the curriculum required by colleges they plan to attend.

The bachelor's degree in pharmacy is the minimum educational qualification for most positions in the profession. However, the master's or doctor's degree in pharmacy or a related field—such as pharmaceutical chemistry, pharmacology (study of the effects of drugs on the body), pharmacognosy (study of the drugs derived from plant or animal sources), or pharmacy administration—usually is required for research work or college teaching. Graduate study also is desirable for pharmacists planning to work in hospitals. Those interested in becoming hospital pharmacists can sometimes secure 1- or 2-year internships which combine graduate or advanced professional study and practical experience in a hospital pharmacy.

Since many pharmacists are self-employed, prospective pharmacists should have business ability as well as the ability to instill confidence in customers. Honesty, integrity, orderliness, and manual dexterity are important attributes for the profession. In addition, accuracy is needed to compound and dispense medicines, as well as keep records required by law.

Pharmacists often begin as employees in community pharmacies. After obtaining some experience and the necessary funds, they may become owners or part owners of pharmacies. A pharmacist who gains experience in a chain drugstore may advance to managerial positions and, later, to a higher executive position within the company. Hospital pharmacists having the necessary training and experience may advance to chief pharmacist or to other administrative positions.

Employment Outlook

Most new pharmacy graduates will find employment readily available through the 1970's. Most new openings will arise each year as pharmacists retire, die, or transfer out of the profession. These openings, together with the anticipated gradual increase in new positions for pharmacists, are expected to provide enough employment opportunities to absorb each year's graduates.

Some employment growth for pharmacists will result from the establishment of new pharmacies, particularly in residential areas or suburban shopping centers; the country's expanding population; the rising standard of medical care; and the growth of Medicaid and other insurance programs that provide for payment of prescription drugs. Many community pharmacies may hire additional pharmacists because of a trend towards shorter working hours. Employment in hospitals probably will rise with the construction of additional facilities and the more extensive use of pharmacists for hospital work. Continued expansion in the manufacture of pharmaceutical products and in research are expected to provide more opportunities for pharmacists in production, research, distribution, and sales. Pharmacists with advanced training will be needed for college teaching and laboratory research.

Earnings and Working Conditions

Beginning pharmacists generally received salaries ranging from \$10,000 to \$14,000 a year in 1970, according to limited information available. The entrance salary in the Federal Civil Service in 1970 for new graduates was \$9,881 or \$11,905 depending on college records and other qualifications.

Experienced pharmacists practicing in community pharmacies in 1970 generally were paid annual salaries of between \$12,000 and \$17,000, according to limited data available. Owners and managers earn more.

Community pharmacists generally work more than the standard 40-hour workweek. Drugstores often are open in the evenings and on weekends, and all States require a registered pharmacist to be in attendance during store hours. Despite the general trend toward shorter hours, 44 hours is still the basic workweek for many salaried pharmacists, and some work 50 hours or more a week. Self-employed pharmacists often work more hours than those in salaried positions. Those who teach or work for industry, government agencies, or hospitals have shorter workweeks. Salaried pharmacists usually receive paid vacations, health insurance, and other fringe benefits.

Sources of Additional Information

General information on pharmacy as a career can be obtained from:

American Pharmaceutical Association, 2215 Constitution Ave. NW., Washington, D.C. 20037.

American Association of Colleges of Pharmacy, 8121 Georgia Ave., Silver Spring, Md. 20910.

Information about student financial aid and chain drug stores may be obtained from:

National Association of Chain Drug Stores, 1911 Jefferson Highway, Arlington, Va. 22202.

Information about retail pharmacies may be obtained from:

National Association of Retail Druggists, 529 14th St., NW., Washington, D.C. 20004.

A list of accredited colleges may be obtained from:

American Council on Pharmaceutical Education, 77 West Washington St., Chicago, Ill. 60602.

Current requirements for licensure in a particular State may be obtained from the Board of Pharmacy of that State or from:

National Association of Boards of Pharmacy, 77 West Washington St., Chicago, Ill. 60602.

Information on college entrance requirements, curriculums, and financial aid is available from the dean of any college of pharmacy.

PODIATRISTS

(D.O.T. 079.108)

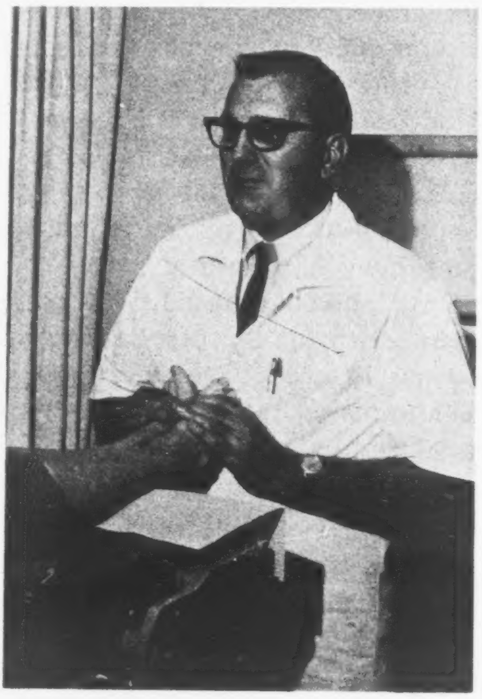
Nature of the Work

Podiatrists (sometimes called *chiropodists*) diagnose and treat diseases and deformities of the feet. They perform foot surgery, prescribe and use drugs and physical therapy, prescribe proper shoes, and fit corrective devices. To help in diagnoses, they take X-rays and perform or prescribe blood and other pathological tests. Among the conditions podiatrists treat are corns, bunions, calluses, ingrown toenails, skin and nail diseases, deformed toes, and arch disabilities. They refer patients to medical doctors whenever they observe symptoms in the feet that may be evidence of medical disorders—such as arthritis, diabetes, or heart or kidney disease.

As a rule, podiatrists provide complete foot care. Some, however, specialize in foot surgery, orthopedics (bone, muscle, and joint disorders), podopediatrics (children's foot ailments), or podogeriatrics (foot problems of the elderly).

Places of Employment

Approximately 7,000 podiatrists were actively engaged in the profession in 1970; about 5 percent were women. Nearly all podiatrists were self-employed. The few who had full-time salaried positions worked mainly in hospitals, podiatric colleges, or for other podiatrists. Small numbers were employed by the Veterans Administration or were commissioned officers in the Armed Forces.



Podiatrists practice mainly in large cities. In early 1970, nearly half were located in four of the most heavily populated States—New York, Pennsylvania, Illinois, and California. In many small towns and rural areas, especially in the South and the Northwest, there were no podiatrists.

Training, Other Qualifications, and Advancement

All States and the District of Columbia require a license for the practice of podiatry. To qualify for a license, an applicant must be a graduate of an accredited 4-year program in a college of podiatric medicine and must pass a State board examination. In addition, three States—Michigan, New Jersey, and Rhode Island—require applicants to serve a 1-year internship in a hospital or clinic after graduation from a college of podiatric medicine. Three-fourths of the States grant licenses without further examination to podiatrists already licensed by another State.

The five colleges of podiatric medicine in the United States admit only students who have already completed at least 2 years of college. This education must include courses in English, chemistry, biology or zoology, physics, and mathematics.

The first 2 years of podiatry education are chiefly in classroom instruction and laboratory work in basic sciences such as anatomy, bacteriology, chemistry, pathology, physiology, and pharmacology. During the final 2 years, students concentrate on obtaining clinical experience. The degree of Doctor of Podiatric Medicine (D.P.M.) is awarded upon graduation. Additional education and experience are generally necessary in order to qualify for work in a specialized area of podiatry. Needy students may obtain loans and scholarships up to $2,500 a year to pursue full-time study leading to a degree in podiatry from Federal funds provided by the Health Professions Educational Assistance Act of 1963, as amended.

Among the personal qualifications considered desirable for a career in this profession are scientific aptitude, manual dexterity, and a good business sense. The ability to get along well with people also is important.

Most newly licensed podiatrists set up their own practices. Some purchase established practices. Others begin by obtaining salaried positions to gain experience and to save the money needed to establish their own practices.

Employment Outlook

The employment outlook for podiatrists is expected to be good through the 1970's. Opportunities for new graduates to establish their own practices, as well as to enter salaried positions, should continue to be favorable.

The demand for podiatrists' services is expected to grow with the demand for other health services. An important factor underlying this anticipated growth is an expanding population with a greater number of older people. This age group, the one needing most foot care, is entitled to certain podiatrists' services under Medicare. Furthermore, the trend toward providing preventive foot care for children is increasing. In addition, more podiatrists will be needed to furnish services in hospitals, extended care facilities, and public health programs.

Earnings and Working Conditions

In podiatry, as in many of the other professions, incomes usually rise markedly after the first years of practice. Earnings of individual podiatrists are determined mainly by such factors as ability, experience, the income level of the community served, and location. Starting salaries of new podiatrists ranged from $10,000 to $12,000 in 1970, according to limited information available. The average net income of experienced podiatrists was about $21,500. Income was generally higher in large cities.

Podiatrists usually work 40 hours a week. They may set their hours to suit their practice.

Sources of Additional Information

Applicants for licenses to practice podiatry in a particular State may obtain information on the requirements for licensure from the State board of examiners in the State capital.

A list of colleges of podiatric medicine, entrance requirements, curriculums, and scholarships are available from:

American Association of Colleges of Podiatric Medicine, 20 Chevy Chase Circle NW., Washington, D.C. 20015.

Additional information on podiatry as a career may be obtained from:

American Podiatry Association, 20 Chevy Chase Circle NW., Washington, D.C. 20015.

CHIROPRACTORS

(D.O.T. 079.108)

Nature of the Work

Chiropractic is a system of treatment based on the principle that a person's health is determined largely by his nervous system, and that interference with this system impairs his normal functions and lowers his resistance to disease. Chiropractors treat their patients primarily by manual manipulation of parts of the body, especially the spinal column.

Because of the emphasis of the importance of the spine and its position, most chiropractors use X-rays extensively to aid in locating the source of patients' difficulties. Many also use such supplementary measures as water, light, and heat therapy, and prescribe diet, exercise, and rest. Some State laws restrict the type of supplementary treatment permitted in chiropractic. Chiropractic as a system for healing does not include the use of drugs or surgery.

Places of Employment

About 16,000 chiropractors were employed in the United States in 1970; about 9 percent were women. Most chiropractors were engaged in independent private practice. Some were salaried assistants of established practitioners or worked for chiropractic clinics and industrial firms. Others taught or conducted research at chiropractic colleges. More than two-fifths of all chiropractors were located in California, New York, Texas, Missouri, and Pennsylvania.

Chiropractor treats patient's spine.

Some of the 11 chiropractic colleges in the United States in 1970 emphasized courses in manipulation and spinal adjustments. Others offered a broader curriculum, including such subjects as physiotherapy and nutrition. In most chiropractic colleges, the first 2 years of the 4-year curriculum are devoted chiefly to classroom and laboratory work in subjects such as anatomy, physiology, and biochemistry. The last 2 years are spent in obtaining practical experience in the colleges' clinics. The degree of Doctor of Chiropractic (D.C.) is awarded to students completing 4 years of chiropractic training.

Chiropractic requires considerable hand dexterity but not unusual strength or endurance. Among personal qualities considered desirable in dealing effectively with patients are sympathy and understanding.

Most newly licensed chiropractors either set up a new practice or purchase an established one. Some start as salaried chiropractors to acquire experience and funds needed to establish their own practice. A moderate financial investment is usually necessary to open and equip an office.

Training, Other Qualifications, and Advancement

Most States and the District of Columbia regulate the practice of chiropractic and grant licenses to chiropractors who meet certain educational requirements and pass a State board examination. The type of practice permitted and the educational requirements for licensure vary considerably from one State to another. In 1970, the States of Louisiana and Mississippi did not regulate the practice of chiropractic or issue licenses.

Most States require successful completion of a 4-year chiropractic course following high school graduation. About three-quarters of the States also require 1 or 2 years of preparatory college work before chiropractic training. Nearly two-fifths of the States also require that chiropractors pass a basic science examination. Chiropractors licensed in one State may obtain a license in another State by reciprocity.

Employment Outlook

The employment outlook for chiropractors is expected to be favorable through the 1970's, though only a slight increase in demand for chiropractic services is expected. However, the anticipated small number of new graduates of chiropractic colleges probably will be insufficient to fill openings created by growth, as well as to replace chiropractors who retire, die, or stop practicing for other reasons. In view of the trend in many States toward raising educational requirements for chiropractic practice, opportunities may be best for those having the most thorough training.

Opportunities for new graduates to begin their own practice are likely to be best in those parts of the country where chiropractic is most fully accepted as a method of health care. Opportunities also should be good for those who wish to enter salaried positions in chiropractic clinics, chiropractic colleges, and other organizations employing chiropractors.

The expected slight growth in demand for chiropractors' services will be related to an expanding population and its increasing demand for health care of various types, including chiropractic treatment.

Women are expected to have good opportunities in chiropractic, since some women and children prefer to be treated by women chiropractors.

Earnings and Working Conditions

In chiropractic, as in other types of independent practice, earnings are relatively low in the beginning but rise after the first few years. Incomes of chiropractors vary widely. Experienced chiropractors generally had average yearly incomes ranging from $14,000 to $28,000 in 1970, according to the limited data available.

Sources of Additional Information

Information on State licensing requirements may be obtained from the State Board of licensing in the capital of the State in which the individual plans to practice.

General information on chiropractic as a career may be obtained from:

American Chiropractic Association, American Building, 2200 Grand Ave., Des Moines, Iowa 50312.

International Chiropractors Association, 741 Brady St., Davenport, Iowa 52805.

OCCUPATIONAL THERAPISTS

(D.O.T. 079.128)

Nature of the Work

Occupational therapists plan and direct educational, vocational and recreational activities designed to help mentally and physically disabled patients become self-sufficient. They work as members of a medical team which, in addition to physicians may include physical therapists, vocational counselors, nurses, social workers, and other specialists.

About one-third of the total number of occupational therapists work with emotionally handicapped patients, and the rest with persons having physical disabilities. These patients represent all age groups and varying degrees of illness.

The treatment or training goals for patients referred for occupational therapy may include regaining physical, mental or emotional stability; developing maximum self-sufficiency in the routine of daily living (such as eating, dressing, writing, and using a telephone); and, in the latter stage of treatment, performing jobs in a practical work situation for eventual return to employment.

As part of the treatment program for adults, occupational therapists teach manual and creative skills, such as weaving and leatherworking, and business and industrial skills such as typing and using power tools. In programs for children, they initiate and direct activities appropriate to the child's maturation level. Therapists may design and make special equipment or splints to aid disabled patients.

In addition to patient care, occupational therapists supervise student therapists, occupational therapy assistants, volunteers, and auxiliary nursing workers. The chief occupational therapist in a hospital may teach medical and nursing students the principles of occupational therapy. Many therapists are administrators and direct occupational therapy programs, coordinate patient activities, or act as consultants to local and State health departments and mental health authorities. Some teach in colleges and universities.

Places of Employment

About 7,500 occupational therapists were employed in 1970; more than 9 out of 10 were women. More than three-fourths of all occupational therapists work in hospitals.

Most of the remainder are employed in rehabilitation centers, custodial care and nursing homes, schools, outpatient clinics, community mental health centers, and research centers. Some work in special workshops, sanitariums, camps for handicapped children and in State health departments. Others are employed in home-care programs for patients unable to attend clinics or work shops. Still others are members of the Armed Forces.

Training, Other Qualifications, and Advancement

The minimum requirement for entry into the profession is a degree or certificate in occupational therapy. In 1970, 36 colleges and universities in the United States offered programs in occupational therapy which were accredited by the American Medical Association and the American Occupational Therapy Association. All of these schools offer a bachelor's degree program for high school graduates or transfer students who have completed 2 years of college. Some of the schools also offer shorter programs leading to a certificate in occupational therapy for students having a bachelor's degree in another field.

The academic work in a 4-year program emphasizes the physical, biological, and behavioral sciences and the application of occupational therapy skills. In addition to the academic work, the training includes 6 to 9 months of supervised clinical experience in hospitals or health agencies. Some programs give part of the clinical experience during the summer or during part of the senior year. The Armed Forces offer programs whereby graduates of approved schools of occupational therapy, who meet the requirements to become commissioned officers, may receive the clinical part of their training while in the service.

Upon graduation and the completion of the clinical practice period, therapists are eligible to take the examination given by the American Occupational Therapy Association. Those who pass this examination may use the initials O.T.R. (Occupational Therapist Registered).

Eight universities offer a program for occupational therapists leading to a master's degree in occupational therapy. The master's degree also is offered at six universities as the first professional degree for persons holding a baccalaureate degree in related fields. A graduate degree often is required for teaching, research, or administrative work.

Newly graduated occupational therapists generally begin as staff therapists. After several years on the job, they may qualify as senior therapists. Experienced therapists may become directors of occupational therapy programs in large hospitals or clinics, or may become teachers. Some high-level positions, such as program coordinators and consultants, also are available in large institutions and agencies.

Personal qualifications needed in this profession include emotional stability and a sympathetic but objective approach to illness and disability. An ability to teach, ingenuity, and imagination also are needed.

Employment Outlook

Employment opportunities for occupational therapists are expected to be excellent through the 1970's. Despite anticipated increases in the number of graduates of occupational therapy programs, the demand for therapists is expected to exceed the supply as public interest in the rehabilitation of disabled persons and the success of established occupational therapy programs increases. Many occupational therapists will be needed to staff the growing number of community health centers and extended care facilities. There will continue to be numerous opportunities to children, and aged persons, as work with psychiatric patients, well as with persons suffering from cerebral palsy, tuberculosis, and heart disease. In addition to openings that will result from growth, many openings will arise because of the need to replace the high proportion of young women who leave the field for marriage and family responsibilities. Opportunities for experienced women who wish to return to work part time after rearing their children should be excellent.

Earnings and Working Conditions

Annual salaries of staff and senior occupational therapists ranged from $8,000 to $10,000 in 1970, according to the American Occupational Therapy Association. Directors of services, coordinators, consultants, and others in top administrative positions generally earned annual salaries of $13,000 to $18,000 in 1970.

In the Federal Government, the beginning annual salary for inexperienced occupational therapists was $7,294 in 1970. More than one-fifth of all occupational therapists in the Federal Government earned $10,500 or more a year.

Most occupational therapists work an 8-hour day, 40-hour week, including some evening work required in a few organizations. Vacation leave usually ranges from 2 to 4 weeks a year, and many positions offer health and retirement benefits.

Sources of Additional Information

American Occupational Therapy Association, 251 Park Avenue South, New York, N.Y. 10010.

OCCUPATIONAL THERAPY ASSISTANTS

(D.O.T. 079.368)

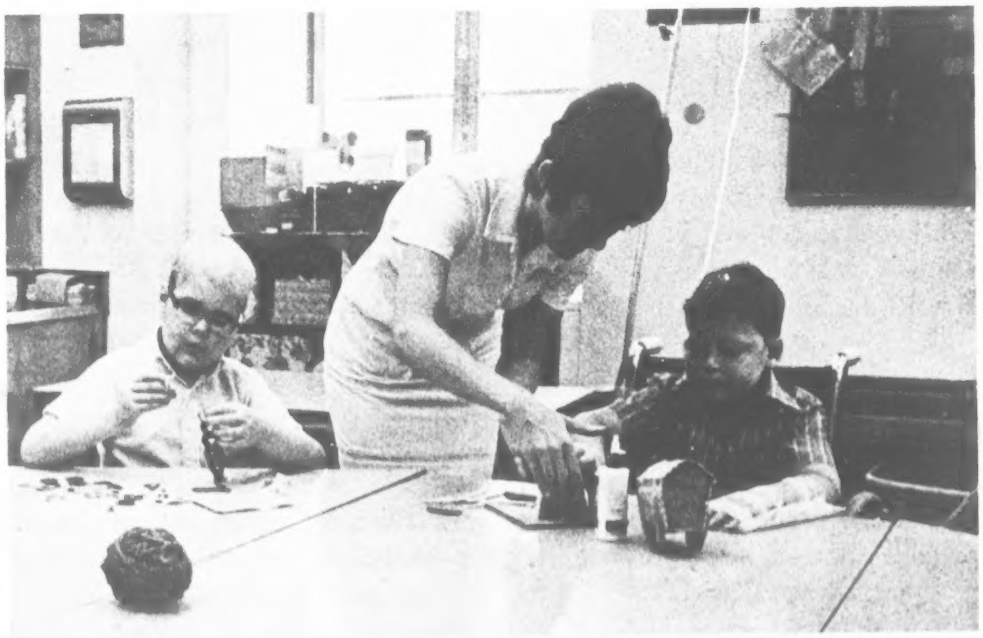
Nature of the Work

Occupational therapy assistants work under the supervision of professional occupational therapists to help rehabilitate patients who are physically and mentally disabled. Through educational, vocational, and recreational activities, they help carry out programs designed to strengthen their patients' muscle power; increase their joint motion and coordination; and develop self-sufficiency in overcoming disabilities.

These rehabilitational activities are usually carried out through instruction in creative skills such as woodworking, ceramics, and graphic arts, or in work-related recreational and social functions such as games, dramatics, and gardening, or in self-care skills such as eating, dressing, and shaving.

The widely varying patients require that assistants be capable of teaching a broad range of skills. They may work either with groups or with individual patients, including those confined to bed. Generally, when treating patients ill with diseases, assistants work under the supervision of professional occupational therapists. In some situations, by contrast, they may work largely independently, with only periodic consultation with professionals—as in activities designed to meet the normal health needs of handicapped persons living in institutions.

Occupational therapy assistants also have a variety of tasks other than working directly with patients. They may order supplies, prepare work materials, and help maintain tools and equipment. At times, they perform clerical duties such as keeping patients' records and preparing clinical notes.



Places of Employment

Approximately 6,000 occupational therapy assistants were employed in the United States in 1970; most were women. The majority of occupational therapy assistants worked in general and specialized hospitals, in occupational therapy departments. Others were employed in rehabilitation centers, homes for the aged, convalescent and nursing homes, schools for handicapped children, day care centers, facilities for the mentally retarded, special workshops, and out-patient clinics. A small number were members of the Armed Forces.

Training, Other Qualifications, and Advancement

Most occupational therapy assistants employed in 1970 qualified through on-the-job training received in hospitals and other health care facilities. Some learned their skills in vocational, technical, and adult education programs or received training in programs sponsored by the Manpower Development and Training Act (MDTA). Detailed information about MDTA-sponsored training is available from State Employment Services. Other assistants were graduated from one- or two-year junior college programs.

Applicants for training programs must be high school graduates or the equivalent. Preference is given to applicants who have taken courses in science and crafts and have previous experience as nursing aides.

Directors of approved programs may recommend that graduates be certified by the American Occupational Therapy Association (AOTA) and receive the title of Certified Occupational Therapy Assistant (C.O.T.A.). In 1970, about 2,000 employed occupational therapy assistants were C.O.T.A.'s. About 25 occupational therapy assistant training programs had AOTA approval in 1970.

AOTA certifies graduates of approved programs, drawn from three categories: (1) hospital-based programs lasting about 25 weeks; (2) one-year vocational school programs; and (3) two-year junior college programs. Each approved program requires completion of designated courses and supervised practical experience. Courses include the history and philosophy of occupational therapy; structure and function of the human body; growth and development from childhood to old age; the effect of illness and injury on patients; and skills, crafts, and activities of daily living and their applications to physical and mental disabilities. Although these basic subjects are common to all categories of approved programs, graduates of junior colleges in addition earn some credits that may be transferred to 4-year colleges.

Young people looking to careers as occupational therapy assistants should have good physical and mental health, a sincere liking for people, and the ability to establish and maintain effective personal relationships. Manual and finger dexterity, to handle tools and materials while instructing patients, as well as good color perception when using colored arts and crafts materials, are also valuable talents for work in occupational therapy.

Employment Outlook

Opportunities for occupational therapy assistants are expected to be excellent through the 1970's, particularly for C.O.T.A.'s. The anticipated growing demand is linked to the factors underlying the rising demand for professional occupational therapists. Public interest in the rehabilitation of disabled persons is increasing. Many assistants will be needed to staff community health centers established under the Mental Retardation Facilities and Community Mental Health Centers Construction Act of 1963.

In addition, many openings will arise because of the need to replace workers who leave the occupation —particularly young women with marriage and family responsibilities. After rearing their own children, experienced women wishing to do so will have good opportunities to re-enter the occupation.

Earnings and Working Conditions

In 1970, weekly salaries generally ranged from $95 to $120 for inexperienced occupational therapy assistants and from $125 to $150 for experienced assistants. Workers who completed training programs approved by the AOTA received higher starting salaries than those paid to beginners without any training.

Occupational therapy assistants generally work indoors although, weather permitting, they may engage patients in suitable outdoor activities. Work hours are usually 8 hours daily, 5 days a week; occasionally, there may be evening and weekend assignments.

Sources of Additional Information

Additional information on a career as an occupational therapy assistant and on programs offering training for the occupation may be obtained from:

The American Occupational Therapy Association, 251 Park Avenue South, New York, N.Y. 10010.

PHYSICAL THERAPISTS

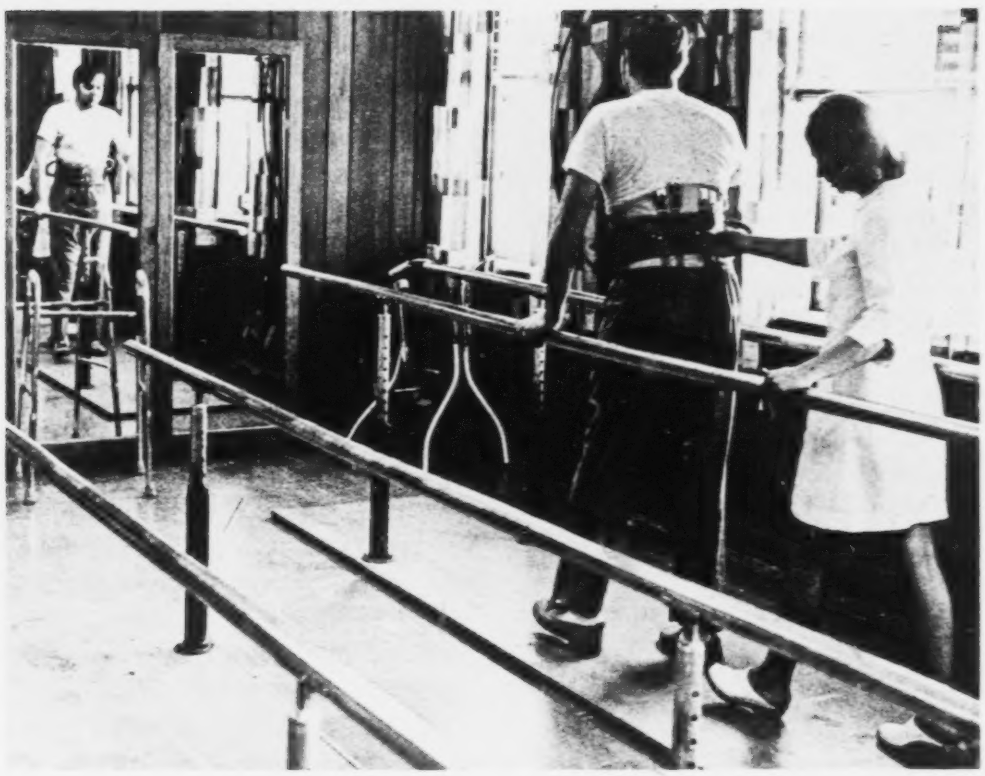
(D.O.T. 079.378)

Nature of the Work

Physical therapists help persons with muscle, nerve, joint, and bone diseases or injuries to overcome their disabilities. They use exercises, mechanical apparatus, massage and applications of heat or cold, light, water, or electricity to treat patients. Most of their patients are accident victims, crippled children, and disabled older persons.

To develop programs for treatment, physical therapists perform muscle, nerve, and other functional tests. They also keep records of their patients' progress during treatments and attend conferences with physicians and other medical personnel to discuss this progress. In many instances, they help disabled persons to accept and adjust to their physical handicaps. They also show members of the patients' families how to continue treatments at home.

Physical therapists are members of a health care team that is directed by a physician and may include a nurse, clinical social worker, occupational therapist, psychologist, vocational counselor, and other specialists. Although qualified physical therapists may treat many types of patients, some specialize in caring for children, or for patients having amputations, arthritis, or paralysis. They also may instruct physical therapy students, as well as students



of related professions and other health workers.

Places of Employment

Approximately 15,000 licensed physical therapists were employed in 1970. About two-thirds of all therapists were women.

About three-fourths of all physical therapists work in general hospitals; in hospitals that specialize in the care of pediatric, orthopedic, psychiatric, or chronically ill patients; and in nursing homes.

Most of the remainder are employed by rehabilitation or treatment centers, schools or societies for crippled children, and public health agencies. Most of these organizations provide treatment for patients having chronic diseases, and some have home visiting programs.

Some therapists work in physicians' offices or clinics, teach in schools of physical therapy, or work for research organizations. Others serve as consultants in government and voluntary agencies. In addition, a few hundred are members of the Armed Forces.

Training, Other Qualifications, and Advancement

A license is required to practice physical therapy in 49 States and the District of Columbia. To obtain a license, an applicant must have a degree or certificate from a school of physical therapy and pass a State board examination. In Texas and Missouri, employers require a degree or certificate from an approved school of physical therapy. In 1970, 52 schools of physical therapy (including the Army Medical Service School) were approved by the American Medical Association and the American Physical Therapy Association. Most of the schools are part of large universities; a few are operated by hospitals, which usually have university affiliations.

Most of the approved schools of physical therapy offer bachelor's degree programs. Some schools provide 1- to 2-year programs for students who have completed some college courses. Other schools accept those who already have a bachelor's degree and give a 12- to 16-month course leading to a certificate in physical therapy. Many schools offer both degree and certificate programs.

Among the courses included in a physical therapy program are anatomy, physiology, pathology, clinical medicine, psychology, electrotherapy, hydrotherapy, massage therapeutic exercise, and administration. In addition to classroom instruction, students are assigned to a hospital or treatment center for supervised clinical experience in the care of patients.

Several universities offer the master's degree in physical therapy. A graduate degree, combined with clinical experience, increases the opportunities for advancement to positions of responsibility in teaching, research, and administration, as well as in the treatment area of physical therapy.

Because an important function of a therapist's job is to help patients and their families understand the treatments and adjust to their handicaps, therapists must have patience, tact, resourcefulness, and emotional stability. In addition, physical therapists should have manual dexterity and physical stamina. For those who wish to determine whether they have the personal qualities needed for this occupation, summer or part-time work as a volunteer in the physical therapy department of a hospital or clinic may prove helpful.

Employment Outlook

Employment opportunities for

physical therapists are expected to be excellent through the 1970's.

The demand for physical therapists is expected to increase very rapidly through the 1970's as the result of increased public recognition of the importance of rehabilitation. Many new positions for physical therapists are expected to be created as programs to aid crippled children and rehabilitation activities are expanded to serve the increasing number of disabled people who require physical therapy. Rapid growth in the number of nursing homes also should result in the need for many more physical therapists to work as staff members. In addition, many openings will continue to arise each year to replace the large number of women who leave the profession for marriage and family responsibilities.

Part-time positions will continue to be available in many communities. These positions are particularly attractive to married women who wish to combine work and family responsibilities.

Increased demands for physical therapy services also will result in greater opportunities for physical therapy assistants who generally obtain their training in junior colleges or on the job in hospitals and other institutions.

Earnings and Working Conditions

New physical therapy graduates received starting salaries ranging between $8,000 and $10,000 in 1970, according to the American Physical Therapy Association. Annual salaries of experienced therapists generally ranged from $14,000 to $20,000. Physical therapists in consultative, educational, or administrative positions earned salaries of $15,000 to $25,000.

In 1970, beginning therapists employed by the Federal Government received annual starting salaries of $7,294; those having high academic standing, however, were offered $8,098. About one-fifth of all physical therapists employed by the Federal Government were earning salaries of $11,905 or more a year.

Most physical therapists work 40 hours a week. Almost all receive 2 weeks of vacation or more, and the majority receive sick leave and other fringe benefits.

Sources of Additional Information

American Physical Therapy Association, 1156 15th St., NW., Washington, D.C.

PHYSICAL THERAPY ASSISTANTS

(D.O.T. 355.878)

Nature of the Work

Physical therapy assistants work under the supervision of professional physical therapists to rehabilitate disabled persons so that they may again lead useful and productive lives. To do this, the assistants must work to restore physical functions in the patients and prevent disability from injury or illness. They also try to improve their patients' general health and strength.

Assistants help physical therapists perform tests on patients to de-

termine the desired treatment and assist in administering it. They position patients for treatment; use special therapy equipment to apply heat, cold, light, sound, and massage; watch closely patients and equipment during treatment and report their findings to supervisors or professionals. Treatments also include helping patients do therapeutic exercises and functional activities such as walking and climbing stairs.

Physical therapy assistants help patients to dress and undress for treatment, and may remove and replace for the patients such devices as braces, splints, and slings, and transport patients to and from treatment areas.

Physical therapy assistants work with patients in the fitting of artificial limbs, braces, and splints, and in instructing them in how to use these prosthetic devices.

Assistants are responsible also for the care and assembling of physical therapy treatment equipment, such as hydrotherapy tanks, as well as cleaning equipment and maintaining a safe environment for the disabled. In addition, assistants do clerical work such as keeping patients' records, making appointments, and acting as receptionists.

Places of Employment

Approximately 10,000 physical therapy assistants were employed in the United States in 1970—about half of them were women. The majority worked in physical therapy departments of general and specialized hospitals. Others were employed in rehabilitation centers, nursing homes for the chronically ill and elderly, community and government agencies providing health services, schools for crippled children, facilities for the mentally retarded, and physicians' or physical therapists' offices and clinics. A small number were members of the Armed Forces.

Training, Other Qualifications, and Advancement

Most physical therapy assistants employed in 1970 qualified for the occupation through training received on the job in hospitals and other health care facilities. Some workers were trained in on-the-job programs sponsored by the Manpower Development and Training Act.

The duration and content of on-the-job programs vary widely, depending on factors such as the level of duties assistants are permitted to perform, the particular services required by different patients when the program is in progress, and the amount of time professional physical therapists can allocate for teaching trainees. Applicants admitted to on-the-job training programs for physical therapy assistants generally must be high school graduates or the equivalent. Employers usually prefer applicants with additional qualifications, such as high school science courses and previous hospital experience as nurse aides.

Other physical therapy assistants learned their skills in vocational, technical, or adult education programs. A small number were trained in 2-year college programs for physical therapy assistants. In the past few years, junior college programs have been established in increasing numbers. In 1970, 25 physical therapy assistant programs were in the planning stage or had been started.

Junior college programs are recommended by the American Physical Therapy Association because they train high-calibre physical therapy assistants. The programs require completion of designated courses, as well as supervised clinical experience. Among the prescribed courses are history and philosophy of rehabilitation; structure and function of the human body; human growth and development; psychology; physical therapy assisting procedures; functional anatomy; and ethics and departmental procedures.

Personal qualifications needed for those planning a career as a physical therapy assistant include: good physical and mental health; manual dexterity to adjust equipment; body coordination to assist in positioning patients; and a sincere interest in helping the physically handicapped.

Employment Outlook

Job opportunities for physical therapy assistants are expected to be excellent through the 1970's particularly for graduates of a 2-year junior college program. Anticipated demand for physical therapy assistants will accompany the growing demand for professional physical therapists. Growth factors include increasing public awareness of the importance of rehabilitation (evidenced by about a threefold growth in the number of persons rehabilitated by Federal and State funds between 1960 and 1970); a growing number of nursing homes which provide therapeutic services to the elderly; and expanded physical therapy services planned by hospitals, nursing homes, schools for crippled children, facilities for mentally retarded, and other health and rehabilitation centers.

In addition, many openings will

arise because of the need to replace workers who die, retire, or leave the occupation for other reasons.

Earnings and Working Conditions

In 1970, weekly salaries generally ranged from $80 to $110 for inexperienced physical therapy assistants and from $110 to $150 for those with experience. Workers who completed 2-year junior college programs received higher starting salaries than those paid beginners without any training.

Physical therapy assistants work indoors in hospitals, clinics, and other health care facilities. They also may work in patients' homes. Working hours are usually 8 hours a day, 5 days a week.

Sources of Additional Information

Additional information on a career as a physical therapy assistant and on programs offering training for the occupation may be obtained from:

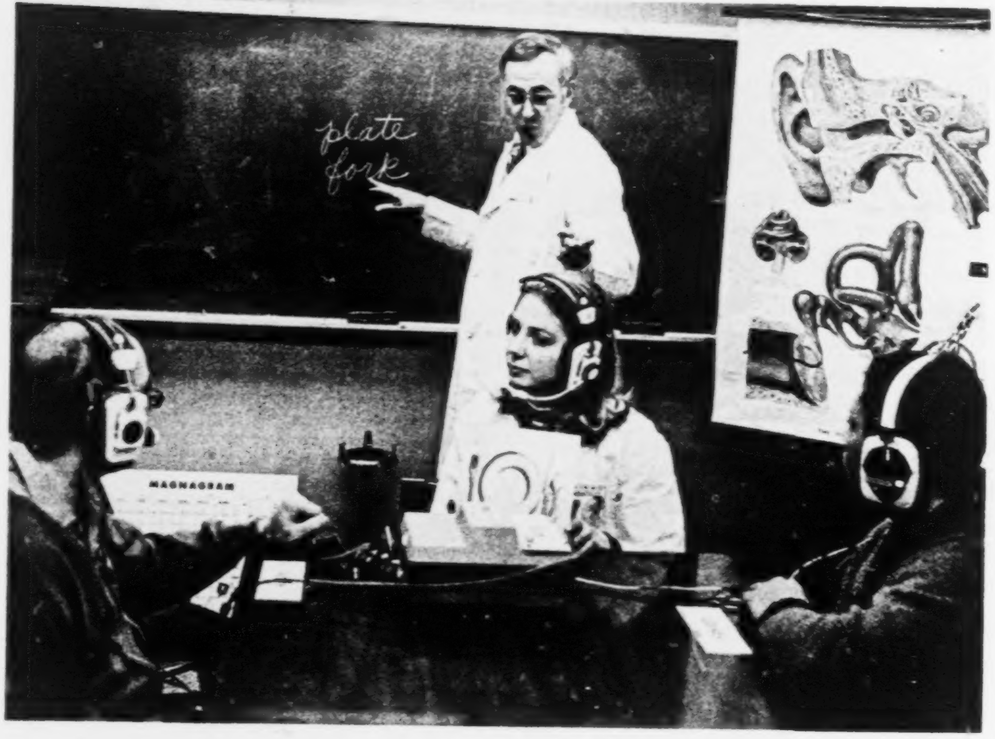
The American Physical Therapy Association, 1156 15th St. NW., Washington, D.C. 20005.

SPEECH PATHOLOGISTS AND AUDIOLOGISTS

(D.O.T. 079.108)

Nature of the Work

The inability to speak or hear clearly is a severe hardship to persons of all ages. Children who have difficulty speaking or hearing usually are unable to play freely with others or to participate fully in normal classroom activities. Adults suffering from speech or hearing impairments often face problems of job adjustment. Speech pathologists and audiologists help persons having such disorders by identifying and evaluating their problems and by providing treatment. In addition, they may conduct research in the speech and hearing field. Some are engaged in training programs in speech pathology and audiology at colleges and universities.



Speech pathologists are concerned primarily with speech and language disorders and audiologists with hearing problems. Speech and hearing, however, are so interrelated that to be competent in either of these occupations, one must have a familiarity with both. The speech pathologist works with children and adults who have speech, language and voice problems resulting from brain injury, cleft-palate, mental retardation, emotional problems, foreign dialect, or other causes. The audiologist also works with children and adults, but concerns himself primarily with the assessment and treatment of hearing problems such as those caused by certain otological or neurological disturbances.

The duties performed by speech pathologists and audiologists vary with their education, experience, and employment setting. In a clinical capacity, they identify and evaluate speech and hearing disorders using various diagnostic procedures. This is followed by an organized program of therapy, with the cooperation of other specialists, such as physicians, psychologists, social workers, physical therapists, counselors, and teachers. Some perform research work, which may consist of investigating communicative disorders and their causes and improving methods for clinical services. Others may supervise clinical activities or perform other administrative work.

Speech pathologists and audiologists working in colleges or universities provide instruction in the principles and bases of communication, communication disorders, and clinical techniques. Many also participate in educational programs for physicians, nurses, teachers, and other professional personnel. In addition, they may work in university clinics and conduct research, usually at university centers.

Places of Employment

Approximately 22,000 persons were employed as speech pathologists and audiologists in 1970. Women represented about three-fourths of total employment. The majority of speech pathologists and audiologists work in public school systems. Colleges and universities employ the next largest number of these specialists in classrooms, clinics, and research centers. The remainder are distributed among hospitals, rehabilitation and community speech and hearing centers, State and Federal Government agencies, industry, and private practice.

Training, Other Qualifications, and Advancement

Although only a few States presently have such a requirement, a master's degree in speech pathology or audiology or its equivalent is being stressed increasingly as the minimum educational standard for employment in public school systems. In addition, many Federal programs, such as Medicare and Medicaid, require that speech and hearing services be given by, or under the supervision of a speech pathologist or audiologist holding a master's degree.

Undergraduate training in speech pathology and audiology should include course work in anatomy, biology, physiology, physics, and in other related areas such as linguistics, semantics, and phonetics. Some specialized course work in speech and hearing, as well as in child psychology and psychology of the exceptional child, also is helpful. This training is usually available at colleges and universities offering a broad liberal arts program.

Graduate education in speech pathology and audiology was offered at 203 colleges and universities in 1970. Professional preparation at the graduate level involves extensive training in the fundamental areas of speech and hearing, including anatomy and physiology, acoustics, and psychological aspects of communication; the nature of speech and hearing disorders; and the assessment, evaluation, and analysis of speech production, language abilities, and auditory processes; as well as familiarity with various research methods used in studying speech and hearing. Persons who wish to work in public schools should complete not only the education and other requirements necessary for a teacher's certificate in the State in which they wish to work, but also may have to fulfill special requirements, prescribed by some States, for people who are going to work with handicapped children.

Many scholarships, fellowships, assistantships, and traineeships are available in colleges and universities; however, most of these are at the graduate level. The U.S. Rehabilitation Services Administration, the Maternal and Child Health Service, the U.S. Office of Education, and the National Institutes of Health allocate funds for teaching and training grants to colleges and universities offering graduate study in speech and hearing. The Veterans Administration and the Rehabilitation Services Administration provide stipends for predoctoral training.

Speech pathologists and audiologists should have an interest and liking for people, and the ability to approach problems with objectivity. To work effectively with persons having speech and hearing disorders, one must be sensitive, patient, and have emotional stability.

Employment Outlook

Employment opportunities for speech pathologists and audiologists who have completed graduate study are expected to be good through the 1970's. Although some positions will be available for individuals having only the bachelor's degree, the increasing emphasis being placed on the master's degree by Federal agencies and State governments will limit opportunities at the bachelor's level.

Many speech pathologists and audiologists will be needed annually through the 1970's to staff new and expanding programs in schools, clinics, colleges and universities, and hospitals. In addition, many will be needed to replace those who die, retire, or leave the profession for other reasons.

Several factors are expected to increase demand for the services of speech pathologists and audiologists during the 1970's: Population growth, which will result in an increase in the absolute number of persons having speech and hearing problems; a lengthening life span, which will increase the number of persons having speech and hearing problems that are common to later life; a rapid expansion in expenditures for medical research; the growing public interest and awareness of the serious problems connected with speech and hearing disorders, as illustrated by the Elementary and Secondary Education Act, as amended, which provides for the education of handicapped children; and expanded Federal programs such as Medicare and Medicaid.

Earnings and Working Conditions

Median salaries of speech pathologists and audiologists employed in colleges and universities ranged from $9,200 to $17,200 for a 9- to 10-month contract period in 1970, according to the American Speech and Hearing Association. Median salaries may be as much as $4,700 higher for an 11- to 12-month contract. Many experienced speech pathologists and audiologists in educational institutions supplement their regular salaries by incomes from consulting, special research projects, and writing books and articles.

The average annual salary for speech pathologists and audiologists in elementary and secondary schools in 1970 was about $10,700 according to an American Speech and Hearing Association survey of members employed in these schools.

In 1970 the annual starting salary in the Federal Government for speech pathologists and audiologists who had completed all requirements for the master's degree was $9,881. Those having doctoral degrees were eligible to start at $13,493.

Most speech pathologists and audiologists work 40 hours a week; however, personnel engaged in research may work longer hours. Almost all employment situations provide fringe benefits such as paid vacations, sick leave, and retirement programs.

Sources of Additional Information

Information on certification requirements for persons wishing to work in public schools can be obtained from the State Department of education at the State capital.

A listing of college and university programs and a booklet on student financial aid as well as general career information can be obtained from:

American Speech and Hearing Association, 9030 Old Georgetown Rd., Washington, D.C. 20014.

MEDICAL LABORATORY WORKERS

(D.O.T. 078.128; .168; .281; and .381)

Nature of the Work

Laboratory tests play an important part in the detection, diagnosis, and treatment of cancer, tuberculosis, diabetes, meningitis, and other diseases. Medical laboratory workers, often called clinical laboratory workers include three levels: medical technologists, technicians, and assistants. They perform tests under the direction of pathologists (physicians who specialize in diagnosing the causes and nature of disease), other physicians or scientists specializing in clinical chemistry, microbiology, or the other biological sciences. Medical laboratory workers use precision instruments, such as microscopes and automatic analyzers, to analyze the blood, tissues, and fluids in the human body. Results of such tests help physicians treat patients.

Medical technologists, who require 4 years of post-secondary training, perform the more complicated chemical, microscopic, and bacteriological tests. These tests may include chemical tests to determine blood cholesterol level, or microscopic examination of the blood to detect the possibility of leukemia. Other body fluids may be examined microscopically; cultured to determine the presence of bacteria, parasites, or other microorganisms; and analyzed for chemical content or reaction. Technologists also may type and crossmatch blood samples. Technologists in small laboratories often perform many types of tests. Those in large laboratories usually specialize in several kinds of related tests in areas such as microbiology, parasitology, biochemistry, blood banking, hematology (the study of blood cells), histology (tissue preparation), cytology (analysis of body cells), and nuclear medical technology (the use of radioactive isotopes to help detect diseases).

Most medical technologists conduct tests related to the examination and treatment of patients. However, some do research on new drugs or on the improvement of laboratory techniques. Others teach or perform administrative duties.

Medical laboratory assistants, who generally do not have college training, assist the medical technologist in routine tests and related work that can be learned in a relatively short time.

Medical laboratory assistants in large laboratories may concentrate in one of several areas. Laboratory assistants working in bacteriology, serology, and parasitology prepare and stain slides for study, apply sensitivity disc to culture plates and record results; and prepare specimens for microscopic studies. Those in hematology collect and perform blood counts and tests to determine

Medical technologist operates automatic blood cell counting machine.

bleeding time, coagulation time, sedimentation rate, and prothrombin time. In clinical chemistry, assistants help analyze samples of body fluids to diagnose and treat diseases. Assistants in the blood bank carry out slide and test tube procedures to identify blood groups and keep blood-bank records. They assist in laboratory techniques such as centrifuging urine samples and preparing the samples for microscopic study.

In basal metabolism and electrocardiography work, they prepare patients for tests as well as operate and maintain testing equipment. In small laboratories, medical laboratory assistants generally work in many areas.

In addition to performing routine tests, assistants may store and label plasma; clean and sterilize laboratory equipment, glassware, and instruments; prepare solutions following standard laboratory formulas and procedures; keep records of tests; and identify specimens.

Medical laboratory technicians generally have a higher level of skill than assistants, but not the technical knowledge of highly-trained technologists. Like technologists and assistants, they may work in several areas or specialize in one field.

Places of Employment

An estimated 110,000 medical laboratory workers were employed in 1970—two-fifths were medical technologists. Approximately 80 to 90 percent of all medical laboratory workers were women. However, the number of men in the field has been increasing in recent years.

About four-fifths of all medical laboratory workers are employed in hospitals. Other places of employment include independent laboratories, physicians' offices, clinics, public health agencies, pharmaceutical firms, and research institutions.

In 1970, about 1,200 medical technologists and about 1,500 medical laboratory technicians and assistants worked in the hospitals and laboratories of the Veterans Administration. Others were employed by the Armed Forces and the U.S Public Health Service.

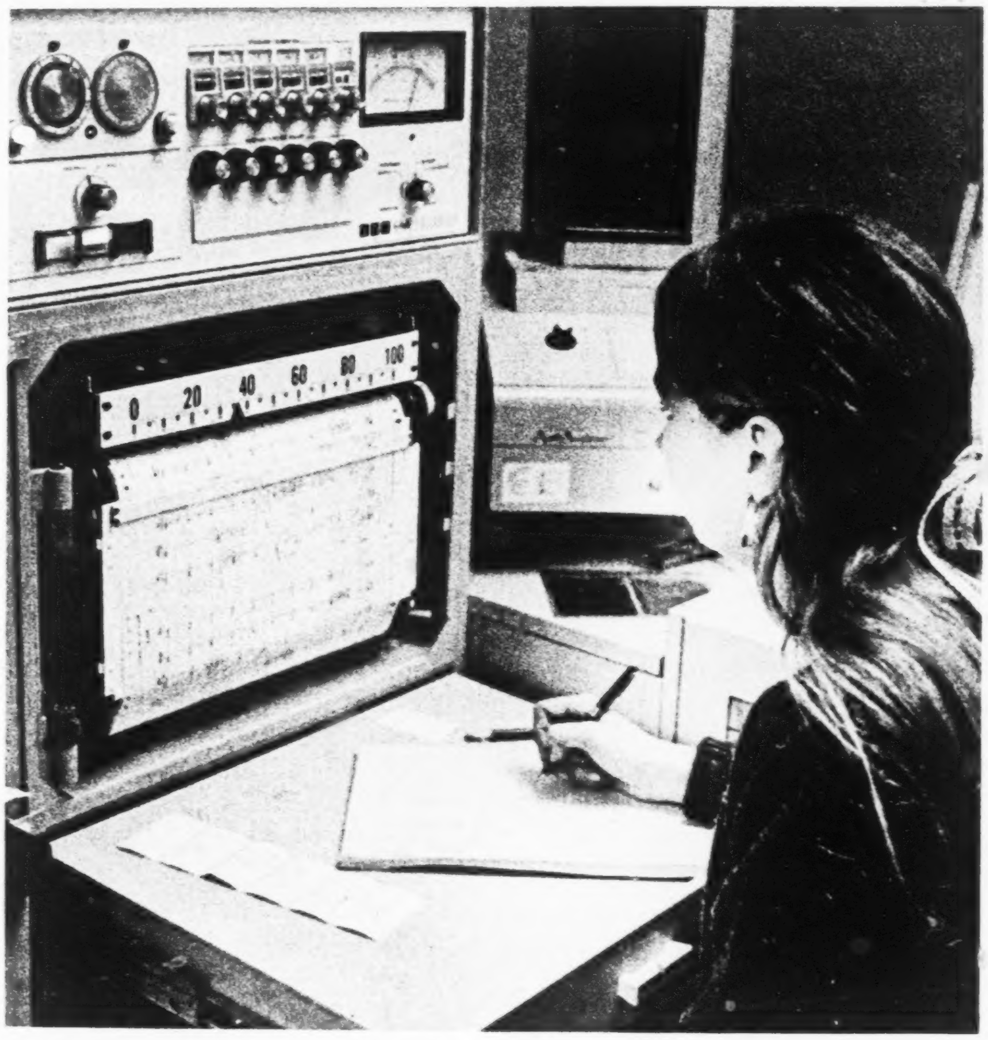
Training, Other Qualifications, and Advancement

The usual minimum educational requirement for beginning medical technologists is 4 years of college including completion of a specialized training program in medical technology approved by the American Medical Association.

Undergraduate work must include courses in chemistry, biological science, and mathematics. Such studies give the technologist a broad understanding of the scientific principles underlying laboratory work. The specialized training usually requires 12 months of study and includes extensive laboratory work. In 1970, such training was given in about 800 hospitals and schools, most of which were affiliated with colleges and universities. A bachelor's degree is often awarded upon completion of the college affiliated program. A few schools require a bachelor's degree for entry into the program.

Many universities also offer advanced degrees in medical technology and related subjects for technologists who plan to specialize in the laboratory or in teaching, administration, or research.

Medical laboratory technicians



Medical technician uses automated chemistry machine.

employed in 1970 had obtained their training in a variety of educational settings. Many had received one or more years of post-secondary education in junior or 4-year colleges and universities. Some technicians have attended private schools, which offer 12- to 18-month programs to high school graduates. Some technicians have gained experience in the Armed Forces. The Navy, for example, conducts a 14-month program to train clinical laboratory and blood bank technicians and the Army has a 50 week "senior medical laboratory specialist" program. A few technicians received training in nonprofit vocational and technical schools.

Most medical laboratory assistants employed in 1970 received their training on the job. In recent years, however, an increasing number have received their training in academic programs conducted by hospitals or vocational schools and junior colleges in cooperation with hospitals. In the future, academic training probably will be required by most employers. Hospitals offer the greatest number of training programs, some of which were established under the Manpower Development and Training Act and the Vocational Education Act. For entry into these programs, graduation from high school with courses in science and mathematics is required generally. The programs last a year and include classroom instruction and practical training in the laboratory. These programs often begin with a general orientation to the clinical laboratory and are followed by courses in bacteriology, serology, parasitology, hematology, clinical chemistry, blood banking, and urinalysis.

Certification examinations, administered by the Board of Medical Technologists of the American Society of Clinical Pathologists (ASCP), are available to graduates of AMA approved schools. Such registration is important because it indicates that a graduate has maintained educational standards recognized by the medical profession. ASCP-registered medical laboratory personnel are preferred by most employers.

In California, Florida, Hawaii, Tennessee, New York City, and Puerto Rico, medical technologists and technicians also must be licensed.

Technologists may be promoted to supervisory positions in certain areas of laboratory work or, after several years' experience, to chief medical technologist in a large hospital. Graduate education in one of the biological sciences or chemistry usually speeds advancement in all areas. Technicians and assistants may have difficulty advancing to medical technologists unless they continue their education and obtain a bachelor's degree in biology or chemistry, or a degree or certificate in medical technology.

Personal characteristics important for medical laboratory work include accuracy, dependability, and the ability to work under pressure. Manual dexterity and the ability to discriminate colors accurately are highly desirable.

Young people interested in a

medical laboratory career should select a training program with considerable care. Information should be obtained about the kinds of jobs obtained by graduates, educational costs, the length of time the training program has been in operation, instructional facilities, and faculty qualifications.

Employment Outlook

Employment opportunities for medical laboratory workers are expected to be excellent through the 1970's. New graduates having a bachelor's degree in medical technology will be sought for entry technologist positions in hospitals. A particularly strong demand is anticipated for technologists having graduate training in biochemistry, microbiology, immunology, and virology. Employment opportunities for medical laboratory technicians and assistants also are expected to be very favorable.

Employment opportunities for medical laboratory personnel are expected to expand as physicians increasingly depend upon laboratory tests in routine physical checkups as well as in the diagnosis and treatment of disease. Also, the construction of additional hospital and medical facilities will increase the demand for these workers. Other factors affecting growth in this field include the country's expanding population; rising standards of living; increasing health consciousness; expanding medical services resulting from new medical techniques and drugs; expanding medical research activities; and extension of prepayment programs for medical care, including Medicare.

Advances in technology in general are expected to stimulate the demand for workers in this occupation. Many new technological developments permit greater numbers and more varieties of tests to be performed. Newly developed automated equipment is not expected to limit the growth of medical technologists. However, the development of new automated equipment that reduces the need for personnel to do simple repetitive tasks may tend to partially offset the growth in demand for the services of medical laboratory assistants.

In addition to medical laboratory workers who will be needed to fill openings resulting from the rapid growth of this field, large numbers also will be needed as replacements because many workers are young women who may leave their jobs for marriage and family responsibilities. Opportunities for part-time employment will continue to be available. Opportunities also should be good for qualified older workers and handicapped persons.

Earnings and Working Conditions

Salaries of medical laboratory workers vary by employer and geographic location of employment. In general, medical laboratory workers employed on the West Coast and in large cities received the highest salaries.

The average starting salary for medical technologists was about $7,500 in 1970, according to limited data available. Beginning salaries for medical laboratory assistants generally ranged from $150 to $250 a month less than those paid medical technologists. Technicians received salaries ranging between those paid technologists and assistants.

Newly graduated medical technologists at the baccalaureate level employed by the Federal Government in 1970 received $6,548. Those having experience, superior academic achievement, or a year of graduate study entered at $8,098. Depending on the amount and type of education and experience, medical laboratory assistants and technicians in the Federal Government earned starting salaries ranging from $4,621 to $5,853 a year in 1970.

Medical laboratory personnel generally work a 40-hour week. In hospitals, they can expect some night or weekend duty. Hospitals generally provide vacation and sick leave benefits; some have retirement plans.

Laboratories are in general well lighted and clean. Although unpleasant odors and specimens of many kinds of diseased tissue often are present, few hazards exist if proper methods of sterilization and handling of specimens, materials, and equipment are used.

Sources of Additional Information

Information about education and training for medical technologists, technicians, and laboratory assistants meeting standards recognized by the medical profession and the U.S. Office of Education as well as career information on these fields of work may be obtained from:

Registry of Medical Technologists of the American Society of Clinical Pathologists, 710 S. Wolcott Ave., Chicago, Ill. 60612.

American Society of Medical Technologists, Suite 1600, Hermann Professional Bldg., Houston, Tex. 77025.

Information about technician training programs offered in private schools may be obtained from:

American Medical Technologists, 710 Higgins Road, Park Ridge, Ill. 60068.

International Society of Clinical Laboratory Technologists, 805 Ambassador Building, 411 North Seventh St., St. Louis, Mo. 63101.

Information about employment opportunities in government clinical and research hospitals may be obtained from the Department of Medicine and Surgery, Veterans Administration, Washington, D.C. 20421, and the Clinical Center, National Institutes of Health, Bethesda, Md., 20014.

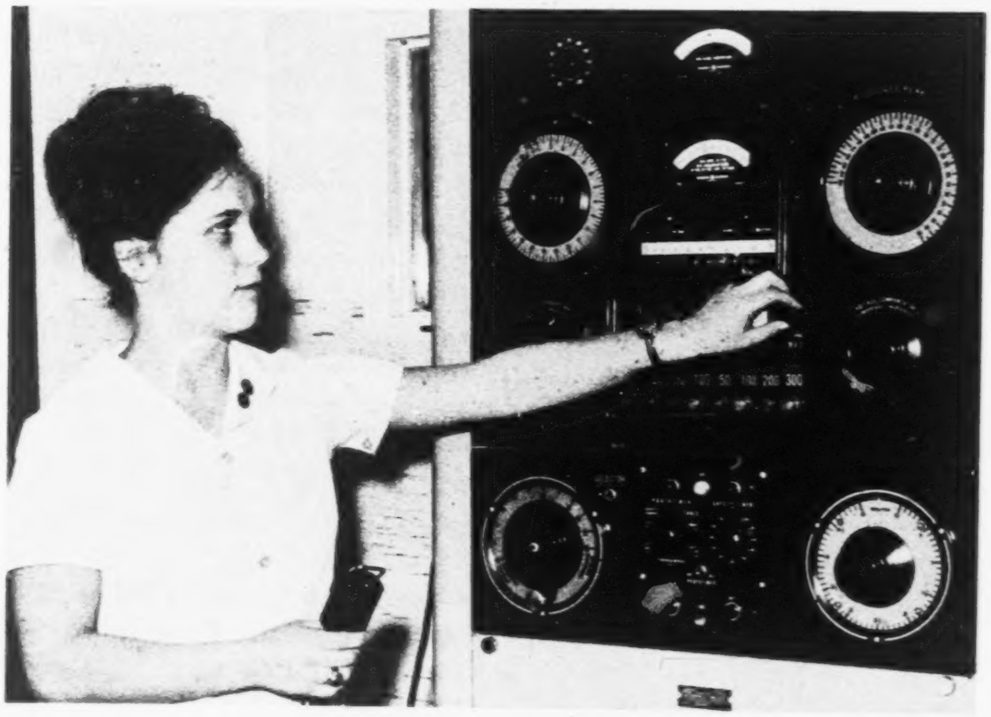
RADIOLOGIC TECHNOLOGISTS

(D.O.T. 078.368)

Nature of the Work

Medical X-rays play a major role in the diagnostic and therapeutic fields of medicine. Radiologic technologists, also called medical X-ray technicians, operate X-ray equipment under the direction of physicians who are usually radiologists (specialists in the use of X-rays).

Most radiologic technologists perform diagnostic work, using X-ray equipment to take pictures of internal parts of the patient's body. They may prepare chemical mixtures, such as barium salts, which the patient swallows to make specific organs appear clearly in X-ray examinations. The technician utilizes proper radiation protection devices and techniques that safeguard against possible radiation hazards. After determining the correct voltage, current, and desired exposure time, the technician positions the patient and makes the required number of radiographs to be developed for interpretation by the physician. The technician may use mobile X-ray equipment at a patient's bedside and in surgery. The technician also is usually responsible for keeping treatment records.



Radiologic technologist determines proper voltage current and exposure time before taking X-ray.

Some radiologic technologists perform radiation therapeutic work. They assist physicians in treating diseases, such as certain cancers, by administering prescribed doses of X-ray or other forms of ionizing radiation to the affected areas of the patient's body. They also may assist the radiologist in measuring and handling radium and other radioactive materials.

Other technicians work in the field of nuclear medicine in which radioactive isotopes are used to diagnose and treat diseases. They assist the radiologist in preparing and administering the prescribed radioisotope and operating special equipment for tracing and measuring radioactivity.

Places of Employment

An estimated 80,000 radiologic technologists were employed in 1970; about two-thirds were women.

Approximately one-third of all radiologic technologists were employed in hospitals; most of the remainder worked in medical laboratories, physicians' and dentists' offices or clinics, Federal and State health agencies, and public school systems. A few worked as members of mobile X-ray teams, engaged mainly in tuberculosis detection.

Training, Other Qualifications, and Advancement

Training programs in X-ray technology are conducted by hospitals or by medical schools affiliated with hospitals. A program in X-ray technology usually takes 24 months to complete. A few schools offer 3- or 4-year programs, and 11 schools award a bachelor's degree in X-ray technology. Also, some junior colleges coordinate academic training with work experience in hospitals in 3-year X-ray technician programs and offer an Associate of Arts degree. In 1970, about 1,200 schools of X-ray technology were approved by the American Medical Association (AMA). In addition to training programs in approved schools, training also may be obtained in the military service. Some courses in X-ray technology are offered by vocational or technical schools.

All of the approved schools accept only high school graduates, and a few require 1 or 2 years of college or graduation from a nursing school. High school courses in mathematics, physics, chemistry, biology, and typing are desirable.

X-ray technology programs usually include courses in anatomy, physiology, nursing procedures, physics, radiation protection, darkroom chemistry, principles of radiographic exposure, X-ray therapy, radiographic positioning, medical ethics, department administration, and the operation and maintenance of equipment.

Registration with the American Registry of Radiologic Technologists is an asset in obtaining highly skilled and specialized positions. Registration requirements include graduation from an approved school of medical X-ray technology and the satisfactory completion of an examination. After registration, the title "Registered Technologist, R.T. (ARRT)" may be used. To become certified in radiation therapy or nuclear medicine, technicians must have completed an additional year of combined classroom study and work experience.

As openings occur, some technicians in large X-ray departments may advance to chief X-ray technician and qualify as instructors in X-ray techniques.

Good health and stamina are important qualifications for this field.

Employment Outlook

Employment opportunities for radiologic technologists are expected to be very good through the 1970's. Part-time opportunities also will be very favorable.

Very rapid growth is expected in the profession, primarily as a result of the anticipated expansion in the use of X-ray equipment in diagnosing and treating diseases; more workers also will be needed to help administer radiotherapy as new knowledge of the medical benefits of radioactive material becomes widespread. X-raying of large groups of people will be extended as part of disease prevention and control programs. For example, many employers now demand that chest X-rays be taken of all employees, and most insurance companies include a chest X-ray as part of the physical examination required for an insurance policy.

In addition to the radiologic technologists needed for new jobs, replacement demands are expected to be high because of the large number of women who leave their jobs each year for marriage or family responsibilities.

Earnings and Working Conditions

Beginning salaries of radiologic technologists employed in hospitals ranged from about $110 to $190 a week in 1970, according to the limited information available.

New graduates of AMA-approved schools of X-ray technology employed by the Federal Government received an annual salary of $5,853 in 1970.

Full-time technicians generally work 8 hours a day and 40 hours a week but may be "on call" for some night or emergency duty. Most are covered by the same vacation and sick leave provisions as other workers in the same organization.

Precautionary measures to protect radiologic technologists from the potential hazards of radiation exposure include the use of safety devices such as individual instruments that measure radiation, lead aprons, leaded gloves, and other shieldings.

Sources of Additional Information

The American Society of Radiologic Technologists, 645 North Michigan Ave., Chicago, Ill. 60611.

The American Registry of Radiologic Technologists, 2600 Wayzata Blvd., Minneapolis, Minn. 55405.

MEDICAL RECORD LIBRARIANS

(D.O.T. 100.388)

Nature of the Work

Medical records contain medical and surgical information on each patient, including case histories of illnesses or injuries, physical examination findings, reports on X-rays and laboratory tests, physicians' orders and notes, and nurses' notes. These records are necessary for correct and prompt diagnosis and treatment. In addition, they are used for research, insurance claims, legal actions, evaluation of treatment and medications prescribed, and for instruction in the training of medical, nursing, and related personnel.

Medical information found in hospital records also is used to plan community health centers and programs and in hospital and health care administration.

Medical record librarians plan, prepare, maintain, and analyze records and reports on patients' illness and treatments. They assist medical staff members in research projects; develop auxiliary records (such as indexes of physicians, diseases treated, and operations performed); compile statistics; make summaries or "abstracts" of medical records; develop systems for documenting, storing and retrieving medical information; direct the activities of the medical record department; and train auxiliary personnel. They usually represent their department at hospital staff meetings and may be called to testify in court.

The size and type of institution employing medical record librarians will affect the duties and amount of responsibility assigned to these workers. In large hospitals, chief medical record librarians supervise other medical record librarians, medical record technicians, and clerical workers. In small hospitals, they may be the only employee in the medical record department and may perform clerical as well as professional duties.

Medical record librarian operates mechanized locator file.

Medical record librarians should not be confused with the medical librarians who work chiefly with books, periodicals, and other publications. (See statement on Librarians.)

Places of Employment

About 13,000 medical record librarians were employed in 1970. Of these, about 4,200 were Registered Record Librarians, according to the American Medical Record Association. In addition, about 41,000 other medical record personnel were working in this field. Most medical record librarians were employed in hospitals. The remainder worked in clinics, medical research centers, nursing homes or other extended care facilities, the medical departments of insurance companies and industrial firms, and in local and State health departments. Although most medical record librarians are women, the number of men in the occupation is growing.

Training, Other Qualifications, and Advancement

In 1970, 28 schools approved by the American Medical Association offered training in medical record library science or medical record administration. These schools are located in colleges and universities and in hospitals.

Most approved medical record librarian educational programs last 4 years and lead to a bachelor's degree in medical record administration. The concentration in medical record administration begins in the third or fourth year of study. One year certificate programs also are available for those who already have a baccalaureate degree and specified courses in the liberal arts and biological sciences.

The specialized curriculum includes both theoretical instruction and practical experience. The required courses include anatomy, physiology, fundamentals of medical science, medical terminology, medical record science, ethics, management, hospital organization and administration, health law, statistics, and data processing. Practical experience involves hospital admitting and discharging procedures; standard indexing and coding practices; compilation of statistical reports; analysis of medical data from clinical records; and experience with medical record systems for the X-ray, pathology, outpatients, and other hospital departments.

Graduates of approved schools in medical record science are eligible for the national registration examination, given by the American Medical Record Association. Upon passing this examination, they receive professional recognition as Registered Record Librarians.

Medical record librarians must be accurate and interested in detail. They also must be able to communicate clearly in speech and writing. Because medical records are confidential, they must be discreet in processing and releasing information. Administrators and supervisors must be able to organize and analyze work procedures and to work effectively with other hospital personnel.

Medical record librarians frequently are supervisors or administrators. They may be assistant directors, directors of a single department, or coordinator of medical record departments of several hospitals. Others may become faculty members of colleges and universities.

Employment Outlook

Employment opportunities for graduates of approved medical record librarian programs are expected to be excellent through the 1970's. In addition to the positions created by growth, many openings will occur as young women leave the field for marriage and family responsibilities. High school graduates will have many opportunities to become medical record technicians to assist librarians.

The increasing number of hospitals and the volume and complexity of hospital records will contribute to a growing demand for medical record librarians.

The importance of medical records will continue to grow rapidly, due to the increased demand for clinical data for research and the use of new drugs. Special interest in the care of the aged has necessitated recording data on conditions of persons in nursing homes and home care programs. More consultants also will be needed to standardize records in these and other areas where medical record librarians are not available. The increasing use of computers to store and retrieve medical information should increase the demand for medical record librarians.

Earnings and Working Conditions

The salaries of medical record librarians are influenced by the location, size, and type of employing institution, as well as by the duties and responsibility of the position. The average salary for chief medical record librarians (registered) in 1970 was $9,000 a year, according to the American Medical Record Association.

Newly graduated medical record librarians employed by the Federal Government generally started at $6,548 a year in 1970; those having bachelor's degrees and high academic records were eligible to begin at $8,098.

Medical record librarians usually work a regular 40-hour week and receive paid holidays and vacations.

Sources of Additional Information

Information about approved schools and employment opportunities may be obtained from:

The American Medical Record Association, 875 N. Michigan Ave.,
Suite 1850, Chicago, Ill. 60611.

DIETITIANS

(D.O.T. 077.081 through .168)

Nature of the Work

Dietitians plan nutritious and appetizing meals to help people maintain or recover good health. Their work includes planning general and modified menus that meet nutritional requirements for health or for medical treatment, supervising the personnel who prepare and serve the meals, managing purchases and

Dietitians discuss patient's menu.

accounts, and providing guidance on good eating habits. Administrative dietitians form the largest group in this occupation; the others are therapeutic dietitians, teachers, or research workers.

Administrative dietitians apply the principles of nutrition and sound management to large-scale meal planning and preparation, such as that done in hospitals, universities, schools, and other institutions. They supervise the preparation of meals; select, train, and direct food-service supervisors and workers; arrange for the buying of food, equipment, and supplies; enforce sanitary and safety regulations; and prepare records and reports. Dietitians who are directors of a dietary department also formulate departmental policy; coordinate dietary service with the activities of other departments; and are responsible for the development and management of the dietary department budget, which in large organizations may amount to millions of dollars annually.

Therapeutic dietitians plan and supervise the service of meals to meet the nutritional needs of patients. They discuss food likes and dislikes with patients and note their intake of food. Other duties of therapeutic dietitians include calculating modified diets, conferring with doctors regarding patients' diets, instructing patients and their families on the requirements and importance of their diets, and suggesting ways to help them stay on these diets after leaving the hospital. In a small institution, one person may serve as both the administrative and therapeutic dietitian.

Some dietitians, particularly those in hospitals affiliated with medical centers, teach dietetic, medical, dental, and nursing students such subjects as dietetics, foods and nutrition, and diet therapy. A few dietitians act as consultants to commercial enterprises, including food processors, equipment manufacturers, and utility companies.

Other members of the profession, called public health nutritionists, conduct studies or surveys of food and nutrition. They also take part in research projects, such as those concerned with the nutritional needs of the aging, persons having chronic diseases, or space travelers.

Places of Employment

About 30,000 dietitians were employed in 1970—less than 10 percent were men. More than two-fifths of all dietitians worked in hospitals and related institutions, including nearly 1,000 who were employed by the Veterans Administration and the U.S. Public Health Service. A sizable number were employed by colleges, universities, and school systems as teachers or as dietitians in food-service programs. Most of the remainder worked for public health agencies, restaurants, or cafeterias, and large companies that operated food-service programs for their employees. Some dietitians were commissioned officers in the Armed Forces.

Training, Other Qualifications, and Advancement

The minimum educational requirement for dietitians is a bachelor's degree with a major in foods and nutrition or institution management. This degree can be obtained in about 400 colleges and universities. Undergraduate work should include courses in foods and nutrition, institution management, chemistry, bacteriology, and physiology, and such related courses as mathematics, psychology, sociology, and economics.

To qualify for professional recognition, The American Dietetic Association recommends the completion after graduation of internship programs or 2 years of pre-planned experience. The programs and experience must be approved by the Association. Many employers prefer to hire dietitians who have completed an internship. An important phase of the intern's education is clinical experience; the remainder of the internship is devoted to classroom study of menu planning, budgeting, management, other advanced subjects, and to special projects. In 1970, 80 internship programs were approved by The American Dietetic Association. Students in a few schools can complete a coordinated education program, also approved by the Association, which qualifies them to practice immediately after graduation, without further internship.

Experienced dietitians may advance to assistant director or director of a dietary department in a large hospital or other institution. Graduate education is usually required for advancement to higher level positions in teaching and research. Those interested in becoming public health nutritionists must usually earn a graduate degree in this field. Graduate study in institutional or business administration is valuable to those interested in administrative dietetics.

Young persons planning to become dietitians should have supervisory ability to manage programs and be able to work well with others. They also should be neat and in good health.

Employment Outlook

Opportunities for qualified dietitians on both a full- and part-time basis are expected to be very good through the 1970's.

The major factors expected to contribute to increasing opportunities for dietitians include the expansion of hospital and nursing home facilities, more widespread use of hospitals and medical services by an increasing population, and the growth of community health programs. An increasing number of dietitians also will be needed to direct food services for schools, industrial plants, and commercial eating places, and to engage in food and nutrition research programs. In addition, since many women select this field because of their interest in food and homemaking and then leave the profession for marriage and family responsibilities, replacement needs probably will continue to be high.

The number of men employed as dietitians has been growing slowly but steadily. Men are likely to find increasing employment opportunities, especially as administrative dietitians in college and university food services, hospitals, and commercial eating places.

In an effort to provide the dietetic services demanded, employers increasingly are hiring workers to assist dietitians. Opportunities will be favorable in these positions for college graduates who have majored in fields such as chemistry or the life sciences.

Earnings and Working Conditions

In 1970, hospitals offered new graduates of approved internship programs annual salaries ranging from $8,900 to $9,750, according to The American Dietetic Association. New graduates without internship generally received lower starting salaries. Experienced dietitians in hospitals were paid between $10,200 and $17,000 a year. Beginning staff dietitians employed by college and school food services received annual salaries ranging from $8,900 to $14,000; experienced dietitians received $11,200 to $16,300.

The entrance salary in the Federal Government in 1970 for those who had completed internship was $8,098 a year. Beginning dietitians who had a master's degree could start at $9,881 a year. Most experienced dietitians employed by the Federal Government earned between $11,000 and $16,000 a year; a few earned over $16,000. Dietitians employed by State and local governments in 1970 received yearly salaries ranging from about $9,200 to $11,800, according to a survey made by the U.S. Department of Health, Education, and Welfare.

Most dietitians are employed on a weekly work schedule of 40 hours; however, dietitians in hospitals may sometimes work on weekends, and those in commercial food service have somewhat irregular hours. Some hospitals provide laundry service and meals in addition to salary. Paid vacations, holidays, and health and retirement benefits are usually received.

Sources of Additional Information

Information on approved dietetic internship programs, scholarships, and employment opportunities, and a list of colleges providing training for a professional career in dietetics, may be obtained from:

The American Dietetic Association, 620 North Michigan Ave., Chicago, Ill. 60611.

The U.S. Civil Service Commission, Washington, D.C. 20415, has information on the requirements for dietetic interns and dietitians in Federal Government hospitals.

HOSPITAL ADMINISTRATORS

(D.O.T. 187.118)

Nature of the Work

Hospital administrators hold the highest executive positions in hospitals; they manage all administrative activities. They usually receive general guidance from a hospital governing board with which they work closely in developing plans and policies.

Administrators direct and coordinate the many varied activities of the hospital. They work closely with the medical and nursing staffs and make available to them needed auxiliary personnel and equipment. They are responsible for hiring and training workers; preparing and administering the budget; establishing accounting procedures; planning current and future space needs; insuring the proper maintenance of buildings and equipment; purchasing supplies and equipment; and providing for laundry, mail, telephone, information, and other services for the patients and staff.

In small hospitals, typically located in rural or suburban areas, the administrator generally assumes all management functions. In large hospitals, he is assisted by specialists trained either in hospital administration or in specialized managerial skills.

Under the direction of the gov-

Hospital administrator confers with member of staff.

erning board, administrators may carry out large projects to expand or develop the hospital's services. They may, for example, organize fund-raising campaigns or plan new medical care, research, or educational programs.

Administrators meet regularly with their staff to discuss progress, make plans and solve problems concerning the functioning of the hospital. Working with the medical staff and department heads, they may develop and maintain teaching programs for nurses, interns, and other hospital staff members. Administrators also may address community gatherings, organize community health campaigns, and participate in planning community health care programs.

Places of Employment

About 17,000 hospital administrators were employed in hospitals and related institutions in 1970. About two-thirds worked in nonprofit or private hospitals and institutions, and the remainder generally worked in Federal, State, and local government hospitals. Of those employed by the Federal Government, most were in Veterans Administration, Armed Forces, and Public Health Service hospitals. About 15 percent of all administrators and their assistants were women; many were members of religious orders.

Training, Other Qualifications, and Advancement

Educational requirements for hospital administrators vary. Most employers prefer applicants with at least a master's degree in hospital administration from an accredited graduate program. Others prefer formal training in social or behavioral sciences, industrial engineering, or business administration, along with extensive experience in the health field. A few require their administrators to be physicians or registered professional nurses. Specialized hospitals (such as mental or orthopedic hospitals) may prefer physicians whose medical specialty is the same as that of the hospital. Hospitals run by religious groups may seek administrators of the same faith.

In 1970, 29 colleges and universities in the United States offered master's degree programs in hospital administration. To enter these programs, applicants must have a bachelor's degree, including courses in natural sciences, psychology, sociology, statistics, accounting, and economics. The programs vary in time allocated to academic study and to administrative residency in hospitals or health agencies but they generally last 2 years. The minimum amount of required academic study is about a year; residency requirements range up to a year.

The curriculum may include courses such as hospital organization and management, accounting and budget control, personnel administration, public health administration, and the economics of health care. The residency involves an orientation to all hospital activities under the supervision of the administrator or his assistant. A Ph. D. in hospital administration, offered in several universities, is especially helpful for those interested in teaching and research.

The American College of Hospital Administrators provides financial loans and scholarships to a limited number of students for graduate work in hospital administration. Some Federal Government awards for graduate training in hospital administration also are available.

New graduates with a master's degree in hospital administration usually enter the field as assistant administrators or department heads and occasionally as administrators in small hospitals. Some persons without a master's degree in hospital administration enter the field by working in one of the specialized administrative areas such as personnel, records, budget and finance, or data processing. With this experience and some graduate work, they may be promoted to department head, to assistant administrator, and eventually to administrator. The position of hospital administrator, especially in a large hospital, represents a career goal, and these positions generally are filled by promotion from within.

Personal qualifications needed for success as a hospital administrator include initiative, vitality, and interest in helping the sick. Skills in working with people, organizing and directing large-scale activities, and public speaking are important assets.

Employment Outlook

Employment opportunities for new graduates having the master's degree in hospital administration are expected to be very good through the 1970's. Applicants without graduate education will find it increasingly difficult to enter this field. Some positions as administrator are likely to continue to be filled by physicians, nurses, or persons experienced in a specialized administrative area.

The number of positions in hospital administration is expected to grow rapidly through the 1970's. As health facilities are expanded to provide additional health services to an increasing population, more positions are likely to be created for hospital administrators, and for administrative assistants, in charge of specific functions or departments. Graduates of programs of hospital administration also will find increasing employment opportunities in related facilities such as nursing homes and other long-term care institutions, rehabilitation facilities, public health centers, health care planning agencies, and hospitalization and health insurance programs.

Earnings and Working Conditions

Salaries of hospital administrators depend on factors such as size, type, and location of the hospital, and size of its administrative staff and budget. Starting salaries for new hospital administration graduates in private hospitals generally ranged from $10,000 to $13,000 a year in 1970. Salaries of experienced administrators generally ranged from $14,000 to $30,000, according to limited data available. New graduates employed in Veterans Administration (VA) hospitals started at $9,881 a year in 1970. Salaries of experienced VA hospital administrators, many of them physicians, ranged from $26,547 to $33,627 a year.

Commissioned officers in the Armed Forces working as hospital administrators hold ranks ranging from second lieutenant to colonel or from ensign to captain. Commanding officers of large Armed Forces hospitals are physicians who may hold higher ranks. Hospital administrators in the U.S. Public Health Service are commissioned officers, holding ranks ranging from lieutenant (junior grade) to captain in the Navy.

Hospital administrators often work long hours. Since hospitals operate on a round-the-clock basis, the administrator may be called upon to settle emergency problems at any time of the day or night. He also may be called on to attend meetings held at various locations outside the hospital. Fringe benefits usually include paid vacations and holidays, sick leave, and pension and insurance coverage.

Sources of Additional Information

Additional information about hospital administration and a list of colleges and universities offering this training may be obtained from:

American College of Hospital Administrators, 840 North Lake Shore Dr., Chicago, Ill. 60611.

Association of University Programs in Hospital Administration, 1 Dupont Circle, NW., Washington, D.C. 20036.

Information on Federal Government awards for graduate training in hospital administration may be obtained from:

Bureau of Health Professions Education and Manpower Training, National Institutes of Health, Bethesda, Md. 20014.

SANITARIANS

(D.O.T. 079.118)

Nature of the Work

Sanitarians are specialists in environmental health. To assure the cleanliness and safety of the food people eat, the liquids they drink, and the air they breathe, sanitarians perform a broad range of duties. They inspect food manufacturing and processing plants, dairies, water supplies, hotels and restaurants, nursing homes, hospitals and schools, waste disposal plants, swimming pools and other recreation facilities, housing, and other places for health hazards. They seek compliance with local regulations and with State and Federal laws relating to public health. They also plan and conduct sanitation programs, administer environmental health programs, and promote the enactment of health regulations and laws.

Sanitarians entering the profession usually begin in public health or agriculture departments, or private industry. They inspect facilities and may collect samples of food, air, and water to test for safety. When necessary, they recommend corrective action according to health laws and regulations. As they progress to more responsible investigational work, they frequently are required to give advice on more complex individual and industrial sanitation problems.

Sanitarians having supervisory duties analyze reports of inspections and investigations made by other environmental health specialists, and advise on difficult or unusual sanitation problems. They also may conduct investigations and give evidence in court cases involving public health regulations. In addition, they promote health laws and engage in health education activities, sometimes teaching classes in hygiene and speaking before student assemblies, civic groups, and other organizations. Those in top management positions are involved with the planning and administration of environmental health programs and their coordination with programs of other agencies. Other duties may include advising government officials on environmental health matters and drafting health laws and regulations.

Public health sanitarians work closely with other health specialists in the community (such as the health officer, sanitary engineer, and public health nurse) to investigate and prevent outbreaks of disease, plan for civil defense and emergency disaster aid, make public health surveys, and conduct health education programs.

In large local and State health or agriculture departments, and in the Federal Government, sanitarians may specialize in a particular area of work, such as milk and other dairy products, food sanitation, refuse and other waste control, air pollution, occupational health, housing, institutional sanitation, and insect and rodent control. In rural areas and small cities, they may be responsible for a wide range of environmental health activities.

The professional sanitarian may be assisted by a sanitarian technician during investigations to determine compliance or lack of compliance with health regulations and laws. The technician takes samples for testing and often performs the required tests.

Increasing numbers of sanitarians are being employed outside government agencies. Many work in industry to prevent or minimize contamination hazards and see that clean, healthful, and safe working conditions exist. For example, in a food processing plant, the sanitarian is concerned with the proper disposal of refuse; the cleaning of plant equipment; the control of micro-organisms; and the proper maintenance of buildings, equipment, and employee facilities.

Sanitarians discuss plan of sewage system.

Where Employed

An estimated 12,000 of the approximately 15,000 professional sanitarians employed in 1970 worked for Federal, State, and local governments. Most of the remainder worked for manufacturers and processors of food products. A small number were teachers in colleges and universities. A few were consultants. Others worked for trade associations, in hospitals, or for other organizations. Probably less than 1 percent of all sanitarians are women.

Sanitarians are employed by public health departments in every State, and by private industry in most States. About half of them work in 10 States: California, Florida, Illinois, Indiana, New York, Ohio, Pennsylvania, Texas, Virginia, and Wisconsin.

In addition to professional sanitarians, about 5,000 sanitarian technicians and aides were employed in 1970.

Training, Other Qualifications, and Advancement

A bachelor's degree in environmental health is the preferred preparation for a beginning job as a professional sanitarian, although a bachelor's degree in a basic science generally is acceptable. High level positions usually require a graduate degree in some aspect of public health. In some cases, sanitarian technicians having 2 years of college and work experience can advance to professional sanitarian positions. However, as hiring standards are raised, it will become harder for persons without a degree to enter the profession.

A typical curriculum leading to a bachelor of science degree in environmental health includes background courses in the humanities, social sciences, mathematics, chemistry, physics and biology. Core courses include microbiology (environmental), biostatistics, epidemiology, community health education, public health organization and administration, environmental health, and field work.

Thirty-six colleges and universities offered undergraduate programs in environmental health in 1970; graduate training in environmental health was available in about 100 universities. Some stipends are available under Federal programs for graduate study in this field.

Beginning sanitarians usually start at the trainee level, where they remain up to a year, working under the supervision of experienced sanitarians. They receive on-the-job training in environmental health practice and learn to evaluate conditions and recommend corrective action. After a few years of experience, they may be promoted to minor supervisory positions with more responsibilities. Increased responsibilities usually come with additional experience; sometimes specialization begins at this level, especially in large local health offices. Further advancement is possible to top supervisory and administrative positions.

To keep abreast of new developments and to supplement their academic training, many sanitarians take specialized short-term training courses in subjects such as occupational health, water supply and pollution control, air pollution, radiological health, milk and food protection, metropolitan planning, and hospital sanitation.

In 1970, 35 States had laws providing for registration of sanitarians; in some States, registration is required to practice. Although requirements for registration vary considerably among the States, the minimum educational requirement usually is a bachelor's degree, with emphasis on the biological, physical, and sanitary sciences.

Among the personal qualities useful to sanitarians is the ability to communicate effectively, since it is necessary to write detailed reports and to deal with persons tactfully concerning the correction of unsanitary conditions. A mechanical aptitude also is helpful, since sanitarians may operate various testing devices.

Employment Outlook

Employment opportunities for sanitarians are expected to be very favorable through the 1970's. Young people without a college degree in one of the physical or biological sciences or in sanitary science will face increasing difficulty in obtaining professional positions in this field.

Employment of sanitarians is expected to increase very rapidly through the 1970's, as State and local health agencies expand their activities in the field of environmental health. Radiological health, occupational health, food protection, solid waste management, and water and air pollution are expected to require the services of more trained personnel as health dangers grow under the stimulus of an expanding, highly technological society.

Air pollution is one example of an existing environmental hazard that has attracted widespread public concern. The discomfort and danger of air pollution and the possible relationship between it and respiratory ailments have attracted attention to the problem. Government on all levels has responded by enacting extensive legislation in environmental quality control. Legislation which regulates the quantity of sulfates or other chemical compounds that can be emitted into the air will increase the demand for professional sanitarians.

The expanding population is another factor intensifying the demand for more trained sanitarians. The migration of people from rural to urban areas, along with the growth of industries, will place a greater strain on the food-service, housing, and water-disposal facilities of urban communities. Some increase in demand for sanitarians is expected in private industry, primarily in the food industry.

Earnings and Working Conditions

Beginning sanitarians having a college degree usually earned from $7,000 to $7,500 in 1970, according to the National Environmental Health Association. Salaries of experienced professional sanitarians generally ranged from $10,000 to $14,000 a year; environmental health directors often earned from $14,000 to $30,000. Sanitary aides and technicians without a college degree generally earned from $5,000 to $8,000 in 1970.

Professional sanitarians employed in the Federal Government began at $6,548 or $8,092 in 1970, depending on their academic records. Experienced sanitarians in the Federal service generally earned from $9,881 to $14,192.

Sanitarians spend considerable time away from their desks. Some come in contact with unpleasant physical surroundings, such as sewage disposal facilities and slum housing. Transportation or gasoline allowances frequently are given, and some health departments provide an automobile.

Sources of Additional Information

Information about careers as sanitarians is available from the following associations:

American Public Health Association, 1790 Broadway, New York, New York 10019.

International Association of Milk, Food and Environmental Sanitarians, Blue Ridge Road, P.O. Box 437, Shelbyville, Indiana 46176.

National Environmental Health Association, 1600 Pennsylvania Street, Denver, Colorado 80203.

Information on stipends for graduate study is available from:

Division of Allied Health Manpower, Bureau of Health Professions Education and Manpower Training, National Institutes of Health, 9000 Rockville Pike, Bethesda, Maryland 20014.

VETERINARIANS

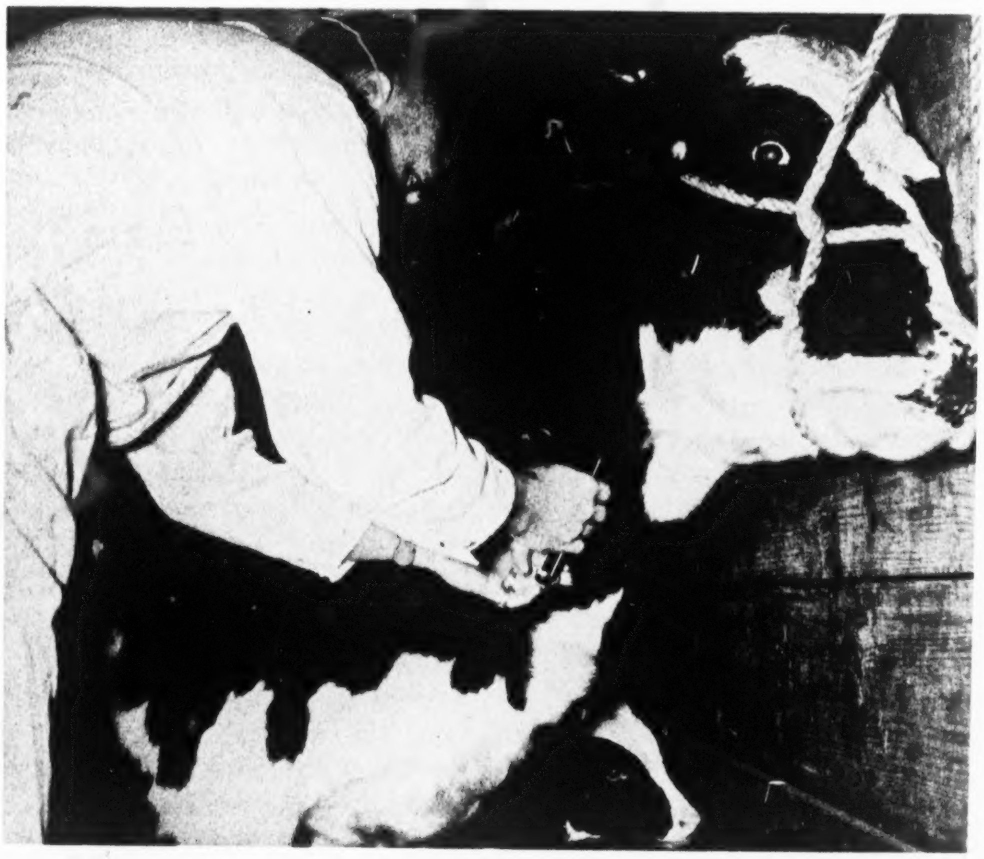
(D.O.T. 073.081 through .281)

Nature of the Work

Veterinarians (doctors of veterinary medicine) diagnose, treat, and control numerous diseases and injuries among animals. Their work is important for the Nation's food production and for public health. Veterinarians perform surgery on sick and injured animals, and prescribe and administer drugs, medicines, serums, and vaccines.

Their work is vital to public health because it helps to prevent the outbreak and spread of diseases among animals. Many of these diseases can be transmitted to human beings.

Veterinarians treat animals in veterinary hospitals and clinics, or on the farm and ranch. In addition,



veterinarians give advice on the care and breeding of animals.

The majority of veterinarians are general practitioners. Of those who are specialists, the greatest number treat small animals or pets. Some specialize in the health care of cattle, poultry, sheep, swine, or horses. Many veterinarians inspect meat, poultry, and other foods as a part of Federal and State public health programs. Still others serve on faculties of veterinary colleges. Some do research related to animal diseases, foods, and drugs, or may act as part of a medical research team, to seek knowledge about prevention and treatment of human disease.

Places of Employment

About 25,000 veterinarians were working in 1970; only 2 percent were women. Almost two-thirds of all veterinarians were in private practice. The Federal Government employed about 2,400 veterinarians, chiefly in the U.S. Department of Agriculture; some worked for the U.S. Public Health Service. About 1,000 more were commissioned officers in the Veterinary Corps of the Army and the Air Force. In addition, many worked for State and local government agencies and a few worked for international health agencies. Some were employed by colleges of veterinary medicine, agricultural colleges, medical schools, research and development laboratories, large livestock farms, animal food companies, and pharmaceutical companies manufacturing drugs for animals.

About two-fifths of all veterinarians in the United States were in seven States—California, New York, Texas, Illinois, Iowa, Ohio, and Pennsylvania. Veterinarians in rural areas chiefly treat farm animals; those in small towns usually engage in general practice; those in cities and suburban areas frequently limit their practice to pets.

Training, Other Qualifications, and Advancement

A license is required to practice veterinary medicine in all States and the District of Columbia. To obtain a license, an applicant must have the degree of Doctor of Veterinary Medicine (D.V.M. or V.M.D.) awarded upon graduation from a veterinary school approved by the American Veterinary Medical Association. He also must pass a State Board examination, and, in a few States, have some practical experience under the supervision of a licensed veterinarian. A limited number of States issue licenses without further examination to veterinarians already licensed by another State.

For positions in research or teaching, an additional master's or Ph. D. degree is usually required in a field such as pathology, physiology, or bacteriology.

Minimum requirements for the D.V.M. or V.M.D. degree are 2 years of preveterinary college work followed by 4 years of study in a college of veterinary medicine. However, most candidates complete 3 or 4 years of a preveterinary curriculum (emphasizing the physical and biological sciences). Veterinary college training includes considerable practical experience diagnosing and treating animal diseases and performing surgery and laboratory work in anatomy, biochemistry, and other scientific and medical subjects.

There were 18 colleges of veterinary medicine in the United States in 1970. Some of the qualifications considered by these colleges in selecting students were scholastic record, amount and character of preveterinary training, health, and an understanding and affection for animals. Since veterinary colleges are largely State supported, residents of the State in which the college is located usually are given preference. In the South and West, regional educational plans permit cooperating States without veterinary schools to send a few students to designated regional schools. In other areas, colleges which accept a certain number of students from other States usually give priority to applicants from nearby States without veterinary schools. The number of women students in veterinary colleges is relatively small; about 9 percent of the students in 1970 were women.

Needy students may obtain loans and scholarships of up to $2,500 a year to pursue full-time study leading to the degree of Doctor of Veterinary Medicine under provisions of the Veterinary Medical Education Act of 1966 and the Health Manpower Act of 1968. The U.S. Department of Agriculture offers students who have completed their junior year in schools of veterinary medicine opportunities to serve as trainees during the summer months.

Some veterinarians begin as assistants to, or partners of, established practitioners. Many start their own practice with a modest financial investment in drugs, instruments, and an automobile. A more substantial financial investment is required to open an animal hospital or purchase an established practice. Newly qualified veterinarians may enter the Army and Air force as commissioned officers, or qualify for Federal positions as meat and poultry inspectors, disease-control workers, epidemiologists, or research assistants.

Veterinarians should have physical strength and courage to handle animals who may become aggressive because of pain or injury. They should be able to work independently and keep abreast of the advances in the profession.

Employment Outlook

Veterinarians are expected to have good employment opportunities through the 1970's. Although an increase in the demand for their services is anticipated, the number of veterinarians will be restricted by the limited capacity of schools. However, some expansion in veterinary school facilities is expected because of passage of the Veterinary Medical Education Act of 1966 which provides for funds to assist in the construction of new educational facilities for veterinary colleges. Nevertheless, most veterinarians who receive degrees will be needed to replace those who retire or die. As a result, the demand for veterinarians will probably exceed the supply during the 1970's.

Among the factors underlying increasing need for veterinary services are the following: An increase in number of livestock and poultry to feed an expanding population; a growing pet population resulting from a trend toward suburban living; and an increase in veterinary research. Emphasis on scientific methods of raising and breeding livestock and poultry, and growth in domestic and international public health and disease-control programs also will probably add to the opportunities for veterinarians.

Earnings and Working Conditions

Veterinarians beginning their own practice generally can cover their expenses the first year and often add to their earnings by working part time for government agencies. As they gain experience, their incomes usually increase substantially.

Newly graduated veterinarians without experience earned $10,539 in the Federal Government in 1970. Those who had demonstrated superior ability in their studies started at $11,905. Summer trainees in the U.S. Department of Agriculture received $155 each week they worked (representing a rate of $8,098 a year) in 1970. Experienced veterinarians working for the Federal Government generally earned between $13,500 and $26,700 a year. The income of veterinarians in private practice usually is higher than that of other veterinarians, according to the limited data available.

Veterinarians sometimes may be exposed to danger of physical injury, disease, and infection. Those in private practice are likely to have long and irregular working hours. Veterinarians in rural areas may have to spend much time traveling to and from farms and may have to work outdoors in all kinds of weather. Veterinarians can continue working well beyond normal retirement age because of many opportunities for part-time work.

Sources of Additional Information

Additional information on veterinary medicine as a career, as well as a list of schools providing training, may be obtained from:

American Veterinary Medical Association, 600 South Michigan Ave., Chicago, Ill. 60605.

Information on opportunities for veterinarians in the U.S. Department of Agriculture is available from:

Agricultural Research Service, U.S. Department of Agriculture, Hyattsville, Md. 20782.

Consumer and Marketing Service, U.S. Department of Agriculture, 536 South Clark St., Chicago, Ill. 60605.

MATHEMATICS AND RELATED FIELDS

Mathematics is both a profession and a tool essential for many kinds of work. As a tool, mathematics, in the form of mathematical language and methods, has been fundamental to understanding and expressing ideas in science, engineering, and human affairs. The application of mathematical methods in these fields has increased greatly because of the widespread use of electronic computers in the natural sciences, medicine, engineering, and management and administration. As a result, employment opportunities for persons trained in mathematics expanded rapidly through the 1960's.

A young person considering a career in mathematics should be able to concentrate for long periods of time. He should enjoy working independently with ideas and solving problems, and must be able to present his findings in finished reports.

This chapter includes descriptions of the occupation of mathematician and the two closely related occupations of statistician and actuary. Entrance into any of these fields requires college training in mathematics. For many types of work, graduate education is necessary.

In addition to professions covered in this chapter, many other workers such as natural scientists and those in data processing, discussed elsewhere in the Handbook, use mathematics extensively.

Secondary school teachers of mathematics are not covered in this chapter but are included in the statement on Secondary School Teachers.

MATHEMATICIANS

(D.O.T. 020.088)

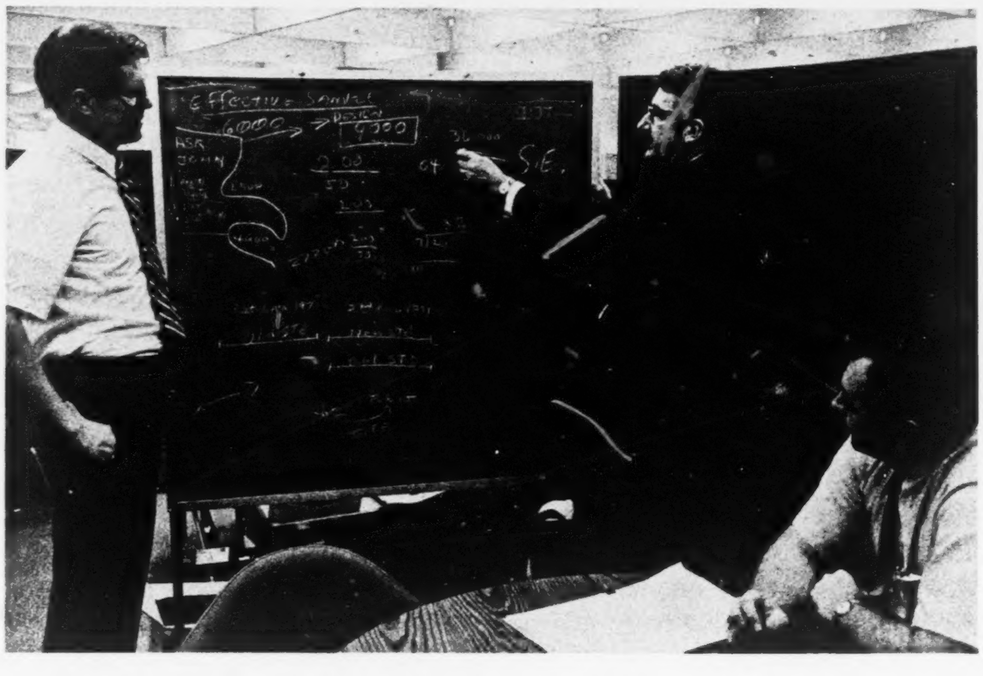
Nature of the Work

Mathematics, one of the oldest and most basic sciences, is also one of the most dynamic and rapidly growing professions. Mathematicians today are engaged in a wide variety of activities, ranging from the creation of new theories to the translation of scientific and managerial problems into mathematical terms.

Mathematical work may be divided into two broad classes: pure or theoretical mathematics; and applied mathematics, which includes mathematical computation. Theoretical mathematicians develop principles and discover relationships among mathematical forms. They seek to increase basic knowledge without necessarily considering its use. Yet, this pure and abstract knowledge has been instrumental in many scientific and engineering achievements. For example, a seemingly impractical non-Euclidean geometry invented by Bernhard Riemann in 1854 became an integral part of the theory of relativity developed by Albert Einstein more than a half-century later.

Mathematicians in applied work develop theories, techniques, and approaches to solve problems in the physical, life, and social sciences. They analyze a problem and describe the existing relationships in mathematical terms. Their work ranges from the analysis of vibrations and stability of rockets in outer space to studies of the effects of new drugs on disease.

Some mathematicians or mathematical statisticians—as they are often called, use mathematical theory to design and improve statistical methods for obtaining and interpreting numerical information. They develop statistical tools in areas such as probability, experimental design, and regression analysis. They frequently work with statisticians when planning and designing experimental surveys.



Mathematicians analyze problem.

In applied mathematics, mathematical knowledge and modern computing equipment are used to obtain numerical answers for specific problems. Some work in this area requires a very high level of mathematical knowledge, skill, and ingenuity. However, much of the work may not require the advanced training and inventiveness of the mathematician. (See statements on Programers and Systems Analysts.)

Applied and pure mathematics are not always sharply separated in practice; many important developments in theoretical mathematics have arisen directly from practical problems. For example, in recent years, John Von Neumann developed the theory of games of strategy to improve the methods of analyzing conflicts between competing interests, such as those occurring in war and economics.

Approximately one-fourth of all mathematicians work in research and development. Nearly one-third are primarily college teachers, many of whom do research part-time. A little less than one-third are in management and administration—about one-half of whom manage and administer research and development programs. Most of the remainder are concerned chiefly with operations research or production and inspection (quality control) of manufactured products.

Places of Employment

An estimated 75,000 mathematicians (including more than 5000 engaged in actuarial work) were employed in the United States in 1970; about 10 percent were women. More than one-half of all mathematicians worked in private industry, primarily in independent research and development firms, and in the ordnance, aircraft, machinery, and electrical equipment industries. Other mathematicians were employed as consultants.

Colleges and universities employed more than one-third of all mathematicians, some of whom have few or no teaching duties. Others were employed by the Federal Government, mostly by the Department of Defense. A few worked for nonprofit organizations and State and local governments.

Mathematicians were employed in all States. However, they were concentrated in States having large industrial areas and sizable college and university enrollments. Nearly half of the total were in seven States—California, New York, Massachusetts, Pennsylvania, Illinois, Maryland, and New Jersey. One-fifth reside in three metropolitan areas—New York, N.Y.; Washington, D.C.; and Los Angeles-Long Beach, Calif.

Training, Other Qualifications, and Advancement

The minimum educational requirement for most beginning positions in mathematics is the bachelor's degree with a major in mathematics, or with a major in an applied field—such as physics or engineering—and a minor in mathematics. For many entrance positions, particularly in research or teaching, graduate training in mathematics is required. Graduate study is also valuable for advancement to more responsible positions in all types of work.

The bachelor's degree in mathematics is offered by over 1,200 colleges and universities throughout the country. The undergraduate mathematics curriculum typically includes courses in analytical geometry, calculus, differential equations, probability and statistics, mathematical analysis, and modern algebra.

Advanced mathematics degrees are conferred by more than 300 colleges and universities. In graduate school, the student builds upon the basic knowledge acquired in the undergraduate curriculum. He usually concentrates on a specific field of mathematics, such as algebra, mathematical analysis, statistics, applied mathematics, or topology, by conducting intensive research and taking advanced courses in that field.

The bachelor's degree is adequate preparation for many positions in private industry and the Federal Government, particularly those connected with computer work. Some new graduates having the bachelor's degree assist senior mathematicians by performing computations and solving less advanced mathematical problems in applied research. Others work as graduate teaching or research assistants in colleges and universities while working toward an advanced degree.

Advanced degrees are required for an ever-increasing number of jobs in industry and Government—in research and in many areas of applied mathematics. The Ph. D. degree is necessary for full faculty status at most colleges and universities, as well as for advanced research positions.

For work in applied mathematics, training in the field to which the mathematics will be applied is very important. Fields in which applied mathematics is used extensively include physics, engineering, and operations research; other fields include business and industrial management, economics, statistics, chemistry, the life sciences, and the behavioral sciences. Training in numerical analysis and programing is especially desirable for mathematicians working with computers.

Employment Outlook

In addition to opportunities resulting from the very rapid growth expected in this field, several thousand mathematicians will be needed each year to replace those who transfer to other fields of work, retire, or die.

As in the 1960's, there will be strong demand for mathematicians holding the Ph. D. degree for teaching and research positions in colleges and universities. Not only is the number of students majoring in mathematics expected to increase sharply, but the number of students majoring in other fields and taking mathematics courses will rise also. Thus, colleges and universities will continue to provide most of the employment opportunities for theoretical mathematicians.

Mathematicians also will be required in substantial numbers to solve an increasingly wide variety of complex research and development problems in engineering, natural and social sciences, military sciences, operations research, and business management. This work requires a high degree of mathematical competence and a broad knowledge of one of these fields of application. Expenditures to support these research and development activities have increased steadily through the 1960's and are expected to continue to rise, although more slowly than in the past.

Between 1970 and 1980, the number of new graduates having degrees in mathematics is expected to at least double. Thus, the number of persons seeking professional mathematics employment is expected to rise sharply, and competition for entry positions may intensify. Graduates who have advanced degrees should find favorable employment opportunities. Those who have only the bachelor's degree, however, probably will face keen competition for entry positions.

The education and training necessary for a degree in mathematics is also an excellent foundation for a number of other occupations, particularly in fields that rely heavily on the application of mathematical theories and methods. Thus, increasing numbers of mathematics graduates are likely to be hired for jobs in high school teaching, statistics, actuarial work, computer programing, systems analysis, economics, engineering, physics, geophysics, and life sciences. Employment opportunities in these related fields probably will be best for those students who combine their mathematics major with a minor in one of these disciplines.

Earnings and Working Conditions

Annual starting salaries in private industry for mathematicians and mathematical statisticians having the bachelor's degree were between $9,300 and $9,600 in 1970, according to limited available information. New graduates having the master's degree received starting salaries which ranged between $2,200 and $2,600 a year higher. Yearly salaries for new graduates having the Ph. D. degree, most of whom had some experience, averaged over $16,000 in 1970.

Depending on their college records, mathematicians having bachelor's degrees and no experience could start in the Federal Government in 1970 at either $7,856 or $9,718. Beginning mathematicians who had completed all requirements for the master's degree could start at $9,718 or $11,526; those having the Ph. D. degree could begin at either $13,096 or $14,192 a year.

According to the American Mathematical Society, college and university teachers in 1970 were paid median salaries which ranged from $8,700 (instructors) to $18,000 (professors) for 9 months of teaching. Some were paid over $30,000 annually. Mathematicians in educational institutions often supplement their regular salaries with income from summer teaching, special research projects, consulting, and writing.

The average (median) annual salary for mathematicians in the National Science Foundation's National Register of Scientific and Technical Personnel was $14,300 in 1970. Only 10 percent earned less than $9,000 a year, and about 10 percent earned $25,000 or more a year.

Sources of Additional Information

General information on the field of mathematics—including career opportunities, professional training, colleges and universities having degree-credit programs, and earnings—may be obtained from *Professional Training in Mathematics,* 25¢, available from:

American Mathematical Society,
P.O. Box 6248, Providence, R.I. 02904.

Professional Opportunities in Mathematics, 35¢, and *Guide Book to Departments in the Mathematical Sciences,* 75¢, both available from:

Mathematical Association of America, 1225 Connecticut Ave. N.W., Washington, D.C. 20036.

Specific information on careers in applied mathematics and electronic computer work may be obtained from:

Association for Computing Machinery, 1133 Avenue of the Americas, New York, N.Y. 10036.

Society for Industrial and Applied Mathematics, 33 South 17th St., Philadelphia, Pa. 19103.

Information on careers in mathematical statistics may be obtained from:

Institute of Mathematical Statistics, Department of Statistics, California State College at Hayward, Hayward, Calif. 94542.

Federal Government career information may be obtained from any regional office of the U.S. Civil Service Commission or from:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20415.

Other sources of information on related occupations, such as Statisticians, Actuaries, Programers, and Systems Analysts may be found elsewhere in the *Handbook*.

STATISTICIANS

(D.O.T. 020.188)

Nature of the Work

More than ever before, the characteristics of the world and its inhabitants are being described in numerical terms. Statisticians collect, develop, analyze, and interpret these data based on their knowledge of statistics and of a particular field, such as economics, demography, behavioral science, education, life science, physical science, or engineering. They may forecast population growth or economic conditions, predict and evaluate the results of new programs, develop quality control tests for manufactured products, or help decision-makers select from alternative choices. Their studies provide government and business officials with the statistical information needed to make decisions and establish policy. Statisticians sometimes work closely with mathematicians and mathematical statisticians. (See statement on Mathematicians elsewhere in this chapter.)

Many statisticians plan surveys, design experiments, or analyze data. Those who plan surveys select the data sources, determine the type and size of the sample groups, and develop the survey questionnaire or reporting form. They prepare the instructions for those who will collect or report the information and for the workers who will code and tabulate the returns. Statisticians who design experiments prepare mathematical models that will test a particular theory. Those in analytical work interpret collected data and summarize their findings in tables, charts, and written reports. Another large group of statisticians chiefly administer statistical programs. A few combine research with teaching. The remainder are involved in other activities such as quality control, operations research, production and sales forecasting, and market research.

Because statistics has such a wide use, it is sometimes difficult to distinguish statisticians from those subject-matter specialists making a limited use of statistics. For example, a statistician working with data on economic conditions may have the title of economist.

Places of Employment

Approximately 24,000 statisticians were employed in 1970; more than one-third were women. Statisticians are employed in nearly all industries; about two-thirds of all statisticians were employed by private industry.

Federal, State, and local Government agencies employed more than one-fourth of all statisticians. The Departments of Commerce; Agriculture; Defense; and Health, Education, and Welfare employed most of those in the Federal Government. Others were employed by colleges and universities, nonprofit organizations, and research institutes.

Although statisticians were employed in all States and areas, about one-third of them worked in three metropolitan areas—New York, N.Y.; Washington, D.C.; and Los Angeles–Long Beach, Calif.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in statistics or mathematics is the minimum educational requirement for many beginning positions in statistics. For other beginning positions in statistics, however, a bachelor's degree with a major in economics or some other subject-matter field and a minor in statistics is preferable. A graduate degree in mathematics or statistics is essential for faculty positions at most colleges and universities, as well as being an asset for advancement to top administrative and consulting positions. Advancement in analytical and survey work usually requires graduate training in the subject-matter field as well as in statistics.

Fewer than 100 colleges and universities offer training leading to a bachelor's degree with a major in statistics. Most schools, however, offer either a degree in mathematics or a sufficient number of courses in statistics to qualify graduates for beginning positions. Courses essential for statisticians include college algebra, plane trigonometry, analytical geometry, differential and integral calculus, linear algebra, and at least one course in statistical methods. Other important courses cover sampling correlation and regression analysis, experimental design, probability theory, and computer uses and techniques. For many quality control positions, training in engineering and in the application of statistical methods to manufacturing processes is desirable. For many market research, business analysis, and forecasting positions, courses in economics, business administration, or a related field are helpful.

Graduate degrees in statistics were conferred by about 60 colleges and universities in 1970, and many other schools offered one or two graduate level statistical courses. Entrance into a graduate program in statistics usually requires a bachelor's degree with a good background in mathematics. The student should attend a school where he can do research in his subject-matter field, as well as take advanced courses in statistics.

Beginning statisticians who have only the bachelor's degree often spend much of their time performing routine statistical work. Through experience, they usually advance to positions of greater technical and supervisory responsibility. Those who have exceptional ability and interest may be promoted to top management positions.

Among the personal qualifications needed by statisticians are an interest and facility in mathematics, and the ability to translate problems into statistical terms.

Employment Outlook

Employment opportunities for well qualified statisticians are expected to be favorable through the 1970's. In addition to new positions resulting from the rapid growth expected in the profession, hundreds of statisticians will be needed annually to replace those who retire, die, or transfer to other fields of work.

Statisticians will be required in increasing numbers by private industry in quality control work in manufacturing. Those having a knowledge of engineering and physical sciences will be needed to work with scientists and engineers in research and development. Business firms are expected to rely more heavily on statisticians to forecast sales, analyze business conditions, modernize accounting procedures, and solve other management problems.

Government agencies will need statisticians for on-going and new programs in fields such as social security, health, education, and economics. Others will be required to teach the anticipated growing numbers of college and professional school students, especially as the more widespread application of statistical methods makes such courses increasingly important to non-mathematics majors.

Along with the expected growth in demand for statisticians, a steady increase in the number of statistics graduates is expected. However, in recent years, the number of these graduates was barely enough to replace those statisticians who retired or died. Thus, employment opportunities for new college graduates who have degrees in statistics are expected to be very good through the 1970's.

Earnings and Working Conditions

Starting salaries for new college graduates employed as statisticians in private industry generally averaged between $7,000 and $8,500 a year in 1970, according to the limited information available. Salaries for beginning statisticians having the master's degree averaged about $1,500 a year more than for those having only the bachelor's degree.

In the Federal Government service in 1970, statisticians who had the bachelor's degree and no experience could start at either $6,548 or $8,098 a year, depending on their scholastic records. Beginning statisticians who had completed all requirements for the master's degree could start at $8,098 or $9,881. Those having the Ph. D. degree could begin at $11,905 or $14,192.

Statisticians employed by colleges and universities generally earn somewhat less than those employed by private industry and the Federal Government. Some indication of the salary levels of statisticians employed as teachers may be obtained from the earnings data for college and university teachers as a group. (See statement on College and University Teachers.) In addition to their regular salaries, statisticians in educational institutions sometimes earn extra income from outside research projects, consulting, and writing.

Sources of Additional Information

General information on career opportunities in statistics may be obtained from:

American Statistical Association,
810 18th St., NW., Washington, D.C. 20006.

Society for Industrial and Applied
Mathematics, 33 South 17th St.,
Philadelphia, Pa. 19103.

Information on Federal Government careers may be obtained from:

Interagency Board of U.S. Civil
Service Examiners for Washington, D.C., 1900 E St. NW.,
Washington, D.C. 20414.

A list of reading materials on career opportunities in the data processing field may be obtained from:

Association for Computing Machinery, 1133 Avenue of the
Americas, New York, N.Y. 10036.

ACTUARIES

(D.O.T. 020.188)

Nature of the Work

Actuaries are responsible for designing insurance and pension plans and for maintaining these programs on a sound financial basis. They are concerned with rates of mortality (death), morbidity (sickness), injury, disability, unemployment, retirement, and property loss from accident, theft, fire, and other potential hazards. Actuaries use statistical data and other pertinent information to construct tables on the probability of insured loss. They develop and analyze estimates of the insurer's future earnings and investment income, expenses, and policyholder

Actuary works with tables showing sickness and death rates.

claims. Taking all these factors into consideration, actuaries determine the premium rates and policy contract provisions for each type of insurance offered. Most actuaries specialize in either life and health insurance or property and liability (casualty) insurance.

To perform their duties effectively, actuaries must keep abreast of general economic and social trends and legislative, health, and other developments that may affect insurance practices. Because of their broad knowledge of insurance, actuaries frequently work on problems arising in investment, underwriting, group insurance, and pension sales and service departments. Actuaries in executive positions may help determine general company policy. In that role, they explain complex technical matters to a variety of laymen, such as other company executives and government officials. They also testify before public agencies on proposed legislation affecting the insurance business or justify intended changes in premium rates or contract provisions.

Actuaries employed by the Federal Government usually deal with a particular insurance or pension program, such as social security (old-age, survivors, disability, and health insurance) or life insurance for veterans and members of the Armed Forces. Actuaries in State government positions supervise and regulate insurance companies, the operation of State retirement or pension systems, and problems connected with unemployment insurance or workmen's compensation. Consulting actuaries set up pensions and welfare plans and make periodic evaluations of these plans for private companies, unions, and government agencies.

Places of Employment

Approximately 5,200 persons were engaged in actuarial work in the United States in 1970. Over 1,700 had full professional status. Less than 3 percent of all actuaries were women. About one-half of all actuaries were employed in the three States that are the major centers of the insurance industry—New York, Connecticut, and Illinois.

Private insurance companies employed about four-fifths of all actuaries. Most worked for life insurance companies; the remainder worked for property and liability (casualty) companies. The size of an insurance company's actuarial staff depends primarily upon the volume of its insurance work. Large companies may employ as many as 50 to 100 actuaries. Small companies may have only a few actuaries on their staffs or rely instead on rating bureaus or consulting firms. Consulting firms and rating bureaus (associations that supply actuarial data to member companies) employed most of the remainder. Several hundred actuaries worked for private organizations administering independent pension and welfare plans or for Federal or State Government agencies. A few taught in colleges and universities.

Training, Other Qualifications, and Advancement

A bachelor's degree with a thorough foundation in calculus, probability, and statistics is required for entry into actuarial work. The new graduate having a major in fields such as mathematics, statistics, economics, or business administration can usually qualify for beginning actuarial positions. The prospective actuary should take courses in algebra, analytical geometry, differential and integral calculus, mathematical statistics, and probability. Other desirable courses include insurance law, economics, investments, accounting, and other aspects of business administration. English and other courses which help develop communication skills also are recommended. Although only 17 colleges and universities offer training specifically designed for actuarial careers, several hundred institutions offer some of the necessary courses.

It usually takes from 5 to 10 years after entering a beginning actuarial position to complete the entire series of examinations required for full professional status. These examinations cover general mathematics, specialized actuarial mathematics, and all phases of the insurance business. Those considering an actuarial career should take the beginning examinations covering general mathematics while still in college. Success in passing these first examinations helps the beginner to evaluate his potential as an actuary. Those who pass these examinations usually have better opportunities for employment and a higher starting salary. The advanced examinations, usually taken by those in junior actuarial positions, require extensive home study and experience in insurance work.

The 10 actuarial examinations for the life insurance and pension field are given by the Society of Actuaries, and the nine for property and liability (casualty) insurance by the Casualty Actuarial Society. Since the first two parts of the examination series of either Society are the same, the student may defer the selection of his insurance specialty until he becomes familiar with the field. "Associate" membership is awarded after completion of five examinations in either specialty; the designation of "Fellow" is conferred after the successful completion of the entire series of examinations.

Employers frequently prefer applicants who have passed one or more actuarial examinations, or who have gained actuarial experience in special summer training programs for college students offered by some insurance companies. A beginning actuary usually rotates among different jobs to learn various actuarial operations and to become familiar with different phases of insurance work. At first, his work may be rather routine, such as preparing calculations or tabulations for actuarial tables or reports. As he gains experience, he may supervise actuarial clerks and prepare correspondence and reports.

Advancement to more responsible work as assistant, associate, and chief actuary depends largely upon the individual's on-the-job performance and the number of actuarial examinations he has successfully completed. Many actuaries, because of their broad knowledge of insurance and related fields, qualify for administrative positions in other company activities, particularly in underwriting, accounting, or data-processing departments. A significant number of actuaries advance to top executive positions.

Employment Outlook

Employment opportunities for actuaries are expected to be excellent through the 1970's. New graduates who have the necessary mathematical education and have passed some actuarial examinations will be in particular demand as trainees.

Actuarial employment is expected to grow rapidly primarily because of the rising numbers of insurance policies of all kinds which result, in part, from the existence of an affluent and more insurance-conscious population and business community. Actuaries will be needed to solve the growing number of problems arising from continuously changing and increasingly complex insurance and pension coverage. The expanding number of group health and life insurance plans and pension and other benefit plans will require actuarial services. Additional actuaries will be needed by government regulatory agencies. Demand will continue to be strong for actuaries capable of working with electronic computers. Some actuaries also will be needed each year to replace those who retire, die, or transfer to other occupations.

Earnings and Working Conditions

Depending on the individual's college records and experience, a new college graduate entering actuarial work as a trainee in an insurance company was paid from $8,000 to $9,500 in 1970. Most insurance companies paid $200 to $600 a year more if the trainee had completed his first actuarial examination and another $600 to $1,100 when he completed the second examination.

Depending on their college records, new graduates with the bachelor's degree entering actuarial work started at either $8,074 or $9,718 a year in the Federal Government in 1970. Those with the master's degree started at $11,526.

Beginning actuaries can look forward to a marked increase in earnings as they gain professional experience and successfully complete either Society's series of examinations. In insurance companies, merit pay increases are given to those who pass one or a group of the examinations. Fellows of either the Society of Actuaries or the Casualty Actuarial Society earn over $18,000 a year and many actuaries earn more than $25,000 a year. Those in executive positions in large companies earn over $35,000.

Sources of Additional Information

Information on professional opportunities and qualifications may be obtained from:

Casualty Actuarial Society, 200 East 42d St., New York, N.Y. 10017.

Society of Actuaries, 208 South LaSalle St., Chicago, Ill. 60604.

NATURAL SCIENCE OCCUPATIONS

The natural sciences are concerned with the physical world and the living things in it. These sciences may be divided into three broad groups—physical, life, and environmental sciences—all of which are discussed in this chapter. Mathematics, often considered part of the natural sciences, is discussed in a separate chapter elsewhere in the *Handbook*.

The physical sciences are the largest field of employment among the natural sciences; about 250,000 physical scientists were employed in 1970. Chemistry is the largest of the physical science specialties; more than 135,000 chemists were employed in 1970. Smaller numbers were employed as physicists (50,000) and as astronomers (1,400). There were more than 20,000 other physical scientists; more than half were metallurgists.

An estimated 180,000 life scientists specialized in 1 of 3 broad fields—agriculture, biology, or medicine. The largest number, more than 70,000, worked in biological sciences. Nearly 50,000 were employed as agricultural scientists, and over 60,000 worked on problems related to medical science.

The environmental sciences are relatively small fields of scientific employment. In 1970, the number of environmental scientists totaled about 42,000. Of these, the largest group were geologists (23,000). Smaller numbers were employed as geophysicists (8,200), oceanographers (6,200), and meteorologists (4,600).

A bachelor's degree is the usual minimum educational requirement for work in the natural sciences. Graduate training is needed for many positions, especially in teaching and research, and is helpful for advancement in all types of work. In many fields, advanced degrees are needed for most positions.

Employment in the natural sciences has grown rapidly in recent years and the outlook is for continued growth through the 1970's. Much of the past employment growth resulted from increases in Federal research and development (R&D) expenditures for space, health, and defense related programs. During the 1970–80 decade R&D expenditures are expected to increase, although at a slower rate than during the 1960's. The anticipated slowdown in Federal R&D spending basically reflects anticipated reductions in the relative importance of the space and defense components of research expenditures. These trends were evidenced in the late 1960's and in 1970. Other factors contributing to the expected employment growth in the natural sciences are the expansion of industry; the increasing complexity of industrial products and processes; and increased science enrollments expected in college and universities, requiring more teachers.

The following chapter presents descriptions of some of the major occupations within the natural sciences. In addition to these occupations, workers in many other fields may require a strong background in the natural sciences. Included are engineering, mathematics, and health service occupations, which are described elsewhere in the *Handbook*.

Environmental Scientists

The environmental sciences are concerned with the history, composition, and characteristics of the earth's land, water, interior, atmosphere, and its environment in space. A large group of the scientists in this field—mainly geologists—explore for new sources of mineral fuels and ores. Some scientists perform basic research to increase scientific knowledge. Others work mainly in applied research; they use knowledge gained from basic research to solve practical problems. Meteorologists, for example, apply scientific knowledge of the atmosphere to forecast weather conditions for specific localities and times. Some of these environmental scientists teach in colleges and universities. Others may administer scientific programs and operations. Environmental scientists also have an important role in solving the problems of a polluted environment.

Many environmental scientists specialize in one particular branch of their broad occupational field. This chapter discusses the specialties and the employment outlook for four environmental science occupations—geologists, geophysicists, meteorologists, and oceanographers.

GEOLOGISTS

(D.O.T. 024.081)

Nature of the Work

Geologists study the structure, composition, and history of the earth's crust. Many geologists spend a large amount of their time in field work. They examine rocks, minerals, and fossils to determine the distribution and relationship both at and beneath the earth's surface. They also gauge the thickness, direction, and slope of rock layers under the earth's surface through rock cores and cuttings by drilling deep into the earth. Geologists also search for natural resources such as coal and water. Exploration usually requires special skills in rock and mineral identification, surveying, map making, data gathering, and technical note taking. Geologists also spend considerable time in laboratories where they examine items or specimens obtained from field work under controlled temperature and pressure conditions. Research includes analysis of physical and chemical properties of minerals, experiments with the flow of water and oil through rocks of various kinds, and study of fossil remains of animal and vegetable life. Geologists use a variety of complex instruments such as the X-ray diffractometer, which determines the structure of minerals, and the petrographic microscope, which permits close study of rock formations and modifications by earth processes. Common tools used by many field geologists include plane tables, levels, transits, well logs, gravity meters, seismographs, magnetometers, aneroid barometers, hammers, cameras, and pocket lenses.

Some geologists administer research and exploration programs. Others teach and work on research projects in colleges and universities. Geologists usually specialize in one or a combination of three general areas—earth materials, earth processes, and earth history.

Geologists concerned with earth materials search for and develop mineral and fuel resources (oil, water, coal, and gas) and examine and classify rocks and fossils according to their chemical and physical properties. They also try to determine the origin, distribution, and migration of certain materials in or on the earth's crust. *Economic geologists* find and sometimes supervise the development of mineral and solid fuel resources. *Petroleum geologists* specialize in the discovery and recovery of liquid fuels—oil and natural gas. Some petroleum geologists spend much time near drilling sites, while others interpret regional geologic data to provide a broad framework of petroleum-related geologic knowledge. *Engineering geologists* apply geological knowledge to engineering problems in the construction of roads, airfields, tunnels, dams, and other large structures. They determine, for example, whether underground rock layers will bear the weight of various structures and buildings, and advise industrial and residential planners. *Petrologists* classify and determine the origin of rock masses. *Mineralogists* examine, analyze, and classify minerals and precious stones according to composition and structure. *Geochemists* study the chemical composition and changes in minerals and rocks to understand better the distribution and migration of elements in the earth's crust.

AND THE
ORIGIN OF TEKTITES.

Geologist makes photo micrographs of rock.

Ground-water geologists specialize in the sources, movement, quality reserves, and availability of subsurface water for human consumption and for industry and agriculture.

Geologists investigating earth processes determine the nature and origin of landforms and their constituents such as rock masses and sedimentary deposits. They also are concerned with eruptive forces such as volcanoes, and the effects of atmospheric conditions producing erosion or glaciation. *Volcanologists* study active and inactive volcanoes, lava flows, and other eruptive activity. They also try to determine the composition of the earth and the elements composing its core. *Sedimentologists* investigate sedimentary rocks to determine their characteristics and formation processes such as erosion, and deposition. *Geomorphologists* study landforms on the earth's surface and its change, including erosion and glaciation, which cause or change them.

Geologists specializing in earth history try to understand and explain the earth's development by determining the age, position, and nature of its fossils. *Paleontologists* trace the evolution and development of past life by studying fossilized remains of plants and animals in geologic formations. *Geochronologists* determine the ages of rocks, ore deposits, or various landforms by radioactive decay of one element or more. *Stratigraphers* study the distribution and relative arrangement of sedimentary rock layers by analyzing their fossil and mineral content.

Increasing numbers of geologists specialize in new fields that require a detailed knowledge of both geology and one or more other sciences. Among these specialists are *Astrogeologists* who are concerned with the geology of extra-terrestrial bodies. They work with lunar maps, and apply knowledge of the earth's geology in studies of conditions on the Moon and the planets. *Computer geologists* use computers and statistical analysis to solve geologic problems. *Geological oceanographers* study the sedimentary and other rocks on the ocean floor and continental shelf. (See statements on Oceanographers and Mining.)

Places of Employment

Approximately 23,000 geologists were employed in the United States in 1970, almost 4 percent were women. Nearly three-fifths of all geologists worked for private industry, mostly for petroleum and natural gas producers. A number of the employees of American petroleum companies worked in foreign countries. Geologists also are employed by mining and quarrying companies. Some geologists specialized in problems related to the construction of dams, bridges, buildings, and highways. Still other geologists worked as independent consultants offering specialized services to industry and government.

The Federal Government employed more than 1,700 geologists, two-thirds of whom worked for the Department of the Interior in the U.S. Geological Survey, the Bureau of Mines, and the Bureau of Reclamation. State agencies also employed geologists, some of whom worked on surveys conducted in cooperation with the U.S. Geological Survey. Although a few positions were in foreign countries, most Federal jobs were in the United States.

Colleges and universities employed more than 6,000 geologists. A few others worked for nonprofit research institutions and museums.

Training, Other Qualifications, and Advancement

Young people seeking professional careers in geology should plan to earn an advanced degree. The master's degree is required for beginning research and teaching and for most positions in exploration. Advancement in college teaching as well as in high-level research and administrative posts usually requires the Ph. D. degree. The bachelor's degree is considered adequate training for only a few entry jobs, primarily in exploration work.

More than 330 colleges and universities offer the bachelor's degree in geology. In the typical undergraduate curriculum, students devote about one-fourth of their time to geology courses, including historical geology, structural geology, mineralogy, petrology, and invertebrate paleontology. About another third of the work is in mathematics, the related natural sciences—such as physics and chemistry—and in engineering; the remainder is in general academic subjects. Statistics and computer usage also are recommended.

More than 160 universities award advanced degrees in geology. Graduate students take advanced courses in geology and specialize in one branch of the science.

Geologists usually begin their careers on field projects, which includes field mapping, or some type of field exploration. Some begin in laboratories as research assistants. After suitable experience, they can be promoted to project leaders, program managers, or other positions in management or research.

The student planning a career in exploration geology should like outdoor activities and have the physical stamina for geological field work. An increasing amount of the work, formerly done in the field, is now accomplished by photogeology, a technique involving the use of color film, infrared and radar imagery to map general geologic features. In addition, a growing number of specialities are laboratory-oriented.

For the most part, geologists work as a team. A curious and analytical mind is necessary in working with complex geological problems. Geologists should be able to adapt to changes brought about by travel to distant points. The ability to express oneself orally and in writing also is important.

Employment Outlook

Employment opportunities for geologists having advanced degrees are expected to be favorable through the 1970's. However, those having a bachelor's degree probably will face keen competition for entry positions, and may have to enter semiprofessional positions, such as technician or surveyor.

Demand for geologists is expected to grow moderately in Federal agencies, particularly the U.S. Geological Survey. College and university employment probably will rise slightly, mainly for those having Ph. D. degrees capable of performing high-level research.

Good opportunities exist for those with training in geology outside the field. For instance, geologists may take training to qualify as science teachers in secondary schools. These positions probably will increase very rapidly in the next decade.

Replacement of geologists who are promoted to managerial positions, or who transfer to other fields, die, or retire, however, are expected to be the chief source of openings.

As world population expands and nations become more industrialized, demand for petroleum and minerals will rise, and increasing numbers of geologists will be required to locate these resources. Geologists also will be needed to devise techniques for exploring deeper within the earth's crust and to work with engineers to develop more efficient methods of recovering natural resources. Increased construction activity demands sand, gravel, and other materials, as well as good building sites. Geologists also will be needed to help find and maintain adequate water supplies, and to develop waste disposal methods which do not contaminate water. Increased emphasis on the environment by urban societies also should affect requirements for geologists. For example, pollution control, land use and reclamation, and highways and other large construction programs all require the assistance of geologists.

Space activities will require geologists to analyze data from the Moon and planets. They also will play an important role in setting up computer systems to store and retrieve geologic data.

The nature of domestic petroleum exploration may alter the need for geologists from year to year, and short-run demand can either exceed or fall short of the number available. However, indications are that employment prospects in petroleum and mineral extraction will be less favorable in the future than they have been in the past.

Earnings and Working Conditions

The average (median) annual starting salary for new geology graduates who have a bachelor's degree was $8,650 in private industry in 1970 according to the American Geological Institute's annual survey. New graduates who have a master's degree averaged $10,500 a year to start. Starting salaries for those who have doctor's degrees averaged $12,000 a year.

Depending on their college records, new graduates who have a bachelor's degree could begin at either $8,510 or $9,448 a year in 1970 in the Federal Government. Those who have a master's degree could start at $9,448 or $10,539 and those who have the Ph. D. degree, at $11,905 or $14,192.

According to the National Science Foundation's National Register of Scientific and Technical Personnel, the average (median) annual salary of earth scientists in 1970 was $14,900. Only 10 percent of the earth scientists earned less than $10,000 and about 10 percent earned more than $23,100.

Teachers often supplement their regular salaries with income from research, consulting, or writing. Extra allowances generally are paid geologists for work outside the United States.

The work of geologists is often active and sometimes strenuous. When their work is outdoors, geologists may be exposed to all kinds of weather. Many geologists travel a great deal and may do field work away from home for long periods. Their hours of work often are uncertain because their field activities are affected by weather and travel.

Sources of Additional Information

General information on career opportunities, training, and earnings for geologists may be obtained from:

American Geological Institute, 2201 M St. NW., Washington, D.C. 20037.

Information on Federal Government careers may be obtained from:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20415.

GEOPHYSICISTS

(D.O.T. 024.081)

Nature of the Work

Geophysics is an overall term covering a number of sciences concerned with the composition and physical aspects of the earth—its size and shape; interior; surface; atmosphere; the land and bodies of water on its surface and underground; and the environment of the earth in space. Geophysicists study the earth's physical characteristics, such as its electric, magnetic, and gravitational fields; the earth's interior heat flow, vibrations, and solar radiation. To conduct their investigations, geophysicists apply the principles and techniques of physics, geology, meteorology, oceanography, geodesy, mathematics, chemistry, and engineering. They use many instruments, including highly complex precision ones such as the seismograph, which measures and records the transmission time and magnitude of earthquake waves or vibrations through the earth; the magnetometer which measures variations in the earth's magnetic field; and the gravimeter which measures minute variations in gravitational attraction. Many tests are conducted in outer space by satellites or interplanetary space probes. In geophysical exploration, increasing use is made of electronic computers to collect and process pertinent data.

Geophysicist uses seismograph to study earth vibrations.

Geophysicists usually specialize in one of three general phases of the science—solid earth, fluid earth, and upper atmosphere.

Geophysicists engaged in work related to the solid earth are concerned with the location of oil and mineral deposits, accurate mapping of the earth's surface, and the behavior of the earth's crust and its properties under the great pressures from its interior.

Exploration geophysicists search for oil and mineral deposits, using the knowledge of earthquake vibrations, the magnetic field, gravitational attraction, and other basic geophysical techniques. Others conduct research, usually to develop new or improved techniques and instruments for prospecting.

Seismologists study the structure of the earth's interior and the vibrations of the earth caused by earthquakes and manmade explosions. They may explore for oil and minerals, provide information for use in designing bridges, dams, and buildings in earthquake regions, or study the problems involved in detecting underground nuclear explosions. Seismologists also play an important role in interpreting data received from the seismograph set up on the moon during the Apollo 12 mission.

Geodesists study the size, shape, and gravitational field of the earth. Their principal task is the accurate mapping of the earth's surface. With the aid of orbiting satellites, geodesists study the earth's surface by determining the positions, elevations, and distances between points on or near it, measure the intensity and direction of gravitational attraction, and determine the distribution of mass within the earth. As man penetrates deeper into space, this task will be extended to other celestial bodies.

Hydrologists are concerned primarily with the fluid earth phase. They study the surface and underground waters in the land areas of the earth, with regard to their occurrence, circulation, distribution, and physical properties. Hydrologists measure rivers and streams, study rainfall, and investigate glaciers, snow, and permafrost. In practical application, some hydrologists are concerned with water supplies, irrigation, flood control, and soil erosion. (Oceanographers, sometimes classified as geophysical scientists, are described elsewhere in this chapter.)

Geophysicists involved in the upper-atmosphere phase investigate the forms and properties of the earth's magnetic and electric fields, and its upper and outer atmosphere. In doing so, some compare and contrast the composition and atmosphere of the Moon, the Sun, and the planets to that of the composition and atmosphere of the earth. *Geomagneticians and Aeronomists* are concerned with the earth's magnetic field—its variations, courses, and forms in space—and with many aspects of space science. *Paleomagneticians* learn about past magnetic fields from rocks or lava flows that captured the earth's magnetism when they solidified. *Tectonophysicists* study the structure of mountains and ocean basins, the properties of materials forming the earth's crust, and the physical forces that formed the mountains and the ocean basins. *Planetologists* study the composition and atmosphere of the Moon, planets, and other massive bodies in the solar system. They depend on the findings of deep space probes manned by astronauts or equipped with geophysical instruments. Geophysicists studying solar-planetary relationships are concerned not only with the Sun's warming rays and visible light but also with its radio, infrared, ultraviolet, X-ray, and energetic particle radiations. These phenomena are investigated by means of radio beams from the earth's surface, and by instruments on satellites and deep space probes. Meteorologists, sometimes classified as geophysical scientists, are discussed separately in this chapter, as is the closely related occupation of geologists. (See also the statement on "Mining".)

Places of Employment

More than 8,000 geophysicists were employed in the United States in 1970. Private industry employed the majority, chiefly in the petroleum and natural gas industry. Other geophysicists were employed by mining companies, exploration and consulting firms, and research institutions. A few were in business for themselves as consultants and provided services on a fee or contract basis to companies and individuals engaged in prospecting or other activities using geophysical techniques.

Geophysicists in private industry were employed mainly in the southwestern and western sections of the United States, including the Gulf Coast, where most of the country's large oil and natural gas fields and mineral deposits are located. Some geophysicists employed by American firms are assigned to work in foreign countries for varying periods of time.

In 1970, Federal Government agencies employed nearly 1,900 geophysicists, geodesists, and hydrologists, mainly in the U.S. Geological Survey; the National Oceanic and Atmospheric Administration (NOAA); the Army Map Service; and the Naval Oceanographic Office. Colleges and universities, State governments, and nonprofit research institutions employed small numbers of geophysicists.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in geophysics or in one of the geophysical specialties qualifies young persons for many beginning jobs in exploration geophysics. A bachelor's degree in a related science or in engineering also is adequate preparation for many beginning jobs, especially in geophysical exploration. However, this study should include courses in geophysics, physics, geology, mathematics, chemistry, and engineering. Some background in electronic data processing is useful.

For geophysical specialties other than exploration, and for the more responsible positions in exploration work, graduate education in geophysics or in a related physical science usually is required. A doctor's degree with a major in geophysics, or in a related science with advanced courses in geophysics, generally is required for teaching careers. The Ph. D. is required frequently for positions involving fundamental research and for advancement in most types of geophysical work.

The bachelor's degree in geophysics is awarded by more than 55 colleges and universities. These undergraduate programs provide training, chiefly in exploration geophysics. Other curriculums that offer the required training for beginning jobs as geophysicists include geophysical technology, geophysical engineering, engineering geology, petroleum geology, and geodesy.

The master's degree and Ph. D. in geophysics are granted by about 70 universities. For admission to a graduate program, a bachelor's degree and a good background in geology, mathematics, physics, or engineering, or a combination of these subjects are the usual requirement. In general, the graduate student should attend a school in which he can take advanced courses and carry out research projects in the aspect of geophysical science in which he has a special interest.

Beginning geophysicists having only the bachelor's degree are usually given on-the-job training in the application of geophysical principles to their employers' projects. If a new employee has not taken the courses in geophysics needed for his job, he is taught geophysical methods and techniques on the job.

Federal Government agencies also have training programs in which a few geophysicists are sent each year to universities for graduate training. Some Federal Government agencies provide a few summer jobs for promising undergraduates and make permanent positions available to them after graduation.

Generally, young geophysicists begin their careers in the field, engaged in either field mapping or exploratory activities. Others may assist senior geophysicists in a research laboratory. Advancement may be to project leader, program manager, or another management or top research position.

The prospective geophysicist should be energetic and in excellent health, since geophysicists often have to work outdoors under somewhat rugged conditions. A willingness to travel is also important, since a geophysicist may be required to move from place to place in the course of his employment. Young students planning careers as geophysicists should be adaptable to these changes.

Geophysicists generally work as part of a team. A curious and analytical mind is necessary in working with complex geophysical problems. The ability to express oneself both orally and in writing also is important.

Employment Outlook

Employment opportunities for new graduates having degrees in geophysics are expected to be good through the 1970's. Opportunities will be best for those having the master's or doctor's degree. There also should be favorable opportunities in geophysical work for well-qualified people having degrees in other sciences if they have had some formal training in geophysics.

Very rapid growth is expected in this profession through the 1970's. Federal Government agencies will need specialists for new or expanded geophysical programs. The petroleum and mining industries will need geophysicists for exploration activities, which are expected to expand in the 1970's. Several hundred new geophysicists also will be needed each year to replace those who leave the profession, retire, or die.

Although the number of job openings for geophysicists is not expected to be large in any 1 year, the number of new graduates having degrees in the science also is expected to be small. As in past years, the number of geophysics graduates who are seeking work as geophysicists probably will be insufficient to meet employers' needs, and well-trained persons having degrees in related sciences and in engineering probably will continue to be hired for geophysical positions.

Over the long run, further growth in the profession is expected. As increasing population leads to more demand for petroleum and mineral products, both the mining industry and the petroleum industry indicate plans to increase their employment of geophysicists. They will be needed to operate highly sophisticated electronic equipment to find the more concealed fuel and mineral deposits, in the face of anticipated slow-downs in conventional exploration activities.

In addition, persons with advanced training in hydrology, seismology, geodesy, and other geophysical specialties will be needed for increasingly important basic research as well as for development of new techniques and instruments. In the Federal Government, more geophysicists will be needed to study problems of the Nation's water supply and mineral resources and to work on both flood control, and air-pollution control and abatement measures. They may be needed also to do research into radioactivity and cosmic and solar radiation as well as to help with exploration of the outer atmosphere and space, through the use of vehicles such as sounding rockets and artificial satellites. Geophysicists also will be needed to establish workable systems for information storage and retrieval for geophysical libraries.

Earnings and Working Conditions

In private industry in 1970 new graduates having bachelor's degrees typically received average starting salaries of $8,650 a year, according to the American Geological Institute's annual salary survey. New graduates having master's degrees averaged $10,500 a year to start. Beginning salaries for those who have doctor's degrees averaged $12,000 a year. In private industry, geophysical scientists working outside the United States usually received bonuses and allowances.

In the Federal Government in late 1970, graduates having bachelor's degrees and no experience could enter most types of geophysical work at either $8,292 or $10,258 a year, depending upon their college records. Those who had completed all requirements for the master's degree could start at $10,258 or $11,526; those having the Ph. D. could start at $13,096 or $14,192. In the Federal Government as in industry, geophysicists stationed outside the United States are paid an additional amount.

According to the National Science Foundation's National Register of Scientific and Technical Personnel, the average (median) annual salary of earth scientists in 1970 was $14,900. Only 10 percent of the earth scientists earned less than $10,000 and about 10 percent earned more than $23,100.

In educational institutions, starting salaries are generally lower than in private industry or in the Federal Government. University teachers, however, may supplement their income by consulting, writing, or research activities.

The work of geophysicists is often active and sometimes strenuous. Exploration geophysicists are subject to reassignment in various locations as exploration activities shift. Their working hours may be irregular and frequently are determined by the requirements of field activities.

Sources of Additional Information

General information on career opportunities, training, and earnings for geophysicists may be obtained from:

American Geophysical Union, 2100 Pennsylvania Ave. NW., Washington, D.C. 20037.

Society of Exploration Geophysicists, P. O. Box 3098, Tulsa, Okla. 74101.

Information on Federal Government careers may be obtained from:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20415.

METEOROLOGISTS

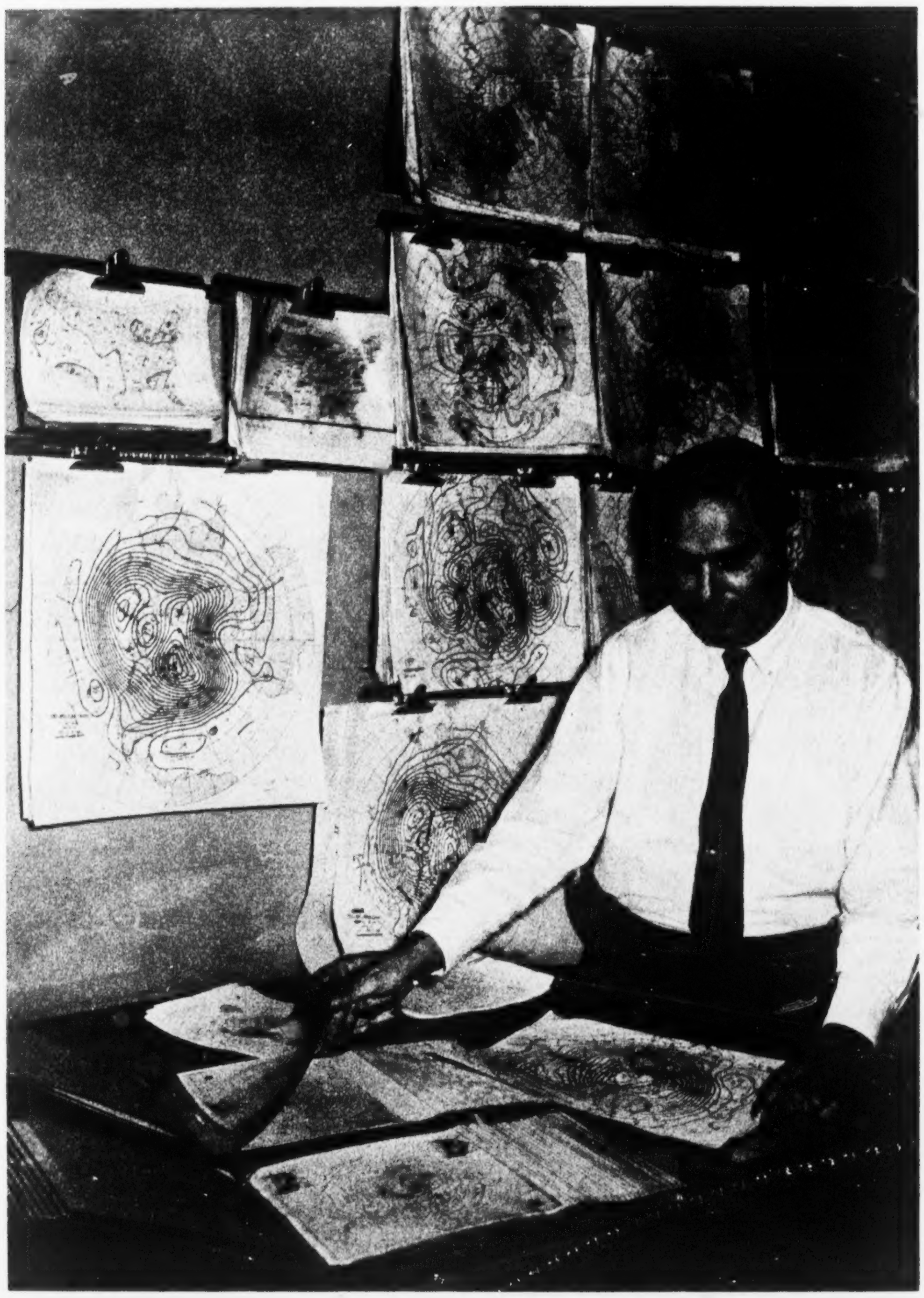
(D.O.T. 025.088)

Nature of the Work

Meteorology is the study of atmospheric phenomena—not only of the earth, but of all celestial bodies. Meteorologists attempt to describe and understand the atmosphere's constituents, motions, processes, and influences. Their knowledge helps solve many practical problems in agriculture, transportation, communications, health, defense, and business.

Meteorologists usually specialize in one branch of the science. Weather forecasters, known professionally as *synoptic meteorologists,* are the largest group of specialists. They interpret current weather information (such as air pressure, temperature, humidity, wind velocity) reported by observers in many parts of the world and by radiosondes and weather satellites. They use their interpretations to make short- and long-range forecasts for specific regions. Some forecasters still prepare and analyze weather maps, but most interpret data directly from computers. *Climatologists* analyze past records on wind, rainfall, sunshine, temperature, and other weather data for a specific area to determine the general pattern of weather which makes up the area's climate. *Paleoclimatologists* study historical climate conditions. Such studies are useful in planning heating and cooling systems, designing structures, and aiding in effective land utilization. *Dynamic meteorologists* investigate the physical laws governing atmospheric motions. These motions range from the great global atmospheric circulations around the earth and other planets, to restless eddies (contrary movements of air). *Physical meteorologists* study the physical nature of the atmosphere, including its chemical composition and electrical, acoustical, and optical properties. They study also the effect of the atmosphere on transmission of light, sound, and radio waves, as well as factors affecting formation of clouds, precipitation, and other weather phenomena. *Meteorological instrumentation specialists* develop the devices that measure, record, and evaluate data on atmospheric processes. For example, some of these instruments are used to measure size and number of droplets in a cloud, structure of winds, and pressure, humidity, and temperature miles above the earth.

Specialists in applied meteorology, sometimes called *industrial meteorologists,* study the relationship between weather and specific human activities, biological processes, and agricultural and industrial operations. For example, they make weather forecasts for individual companies, attempt to induce rain or snow in a given area, and work on problems such as



Meteorologist compares predicted circulation patterns with those of previous years.

smoke control and air pollution abatement.

Almost one-third of all civilian meteorologists are engaged in research and development. They are concerned, for example, with devising mathematical models of atmospheric motion as an aid to changing weather conditions, or in carrying out experiments designed to modify the formation of rain. Approximately one-third are engaged primarily in weather forecasting, and about one-fourth manage or administer forecasting and research programs. In both weather forecasting and research, meteorologists use electronic computers to tabulate and file large amounts of data.

A number of meteorologists teach or do research—frequently combining the two activities—in universities or colleges. In colleges without separate departments of meteorology, they may teach geography, mathematics, physics, chemistry, or geology, as well as meteorology.

Places of Employment

Nearly 4,400 civilian meteorologists were employed in the United States in 1970; approximately 2 percent were women. The National Oceanic and Atmospheric Administration (NOAA), which includes the National Weather Service, employed by far the largest number of civilian meteorologists—nearly 2,000—at 300 stations in all parts of the United States, the polar regions, Puerto Rico, Wake Island, and other Pacific area sites. A few worked for other Federal Government agencies. The Armed Forces employed more than 300 civilian professional meteorologists.

More than 800 meteorologists worked for private industry. Commercial airlines employed several hundred to forecast weather along flight routes and to brief pilots on atmospheric conditions. Others worked for private weather consulting firms, which provided special weather information for a fee, for companies that designed and manufactured meteorological instruments, and for large firms in aerospace, insurance, utilities, and other industries.

Colleges and universities employed more than 1,000 meteorologists in research and teaching. Several hundred others worked for

State and local governments and for nonprofit organizations.

In addition to these civilian meteorologists, more than 2,400 officers and 1,500 enlisted members of the Armed Forces were engaged in forecasting and other meteorological work in 1970.

Although meteorologists are employed in all States, nearly two-fifths were located in just two States—California and Maryland. More than one-tenth of all meteorologists were employed in the Washington, D.C. metropolitan area.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in meteorology is the usual minimum educational requirement for beginning meteorologists in weather forecasting. However, a bachelor's degree in a related science or in engineering is acceptable for many positions, provided the applicant has credit for courses in meteorology. For example, the Federal Government's minimum requirement for beginning positions is a bachelor's degree, at least 20 semester hours of study in meteorology (6 hours each in synoptic meteorology and dynamic meteorology) and additional training in physics and mathematics, including calculus.

For research and teaching and for many top-level positions in other meteorological activities, an advanced degree is essential, preferably in meteorology. However, persons having graduate degrees in other sciences also may qualify if they have taken advanced meteorology, physics, mathematics, and chemistry.

About 55 colleges and universities in 1970 offered degree-credit programs in meteorology or specialized meteorological disciplines; 32 of these schools granted advanced degrees in the atmospheric sciences. Many other institutions offered courses in meteorology.

Meteorology training is given or supported by the Armed Forces. In 1970, more than 500 commissioned officers received university training in meteorology at either the undergraduate or graduate level. In addition, over 200 enlisted personnel were being sponsored in college and university programs leading to an undergraduate degree and commission. Ex-servicemen who have experience as meteorologists frequently are qualified for civilian meteorologist positions, not only with the Armed Forces, but with other employers as well.

The NOAA has an in-service training program under which some of its meteorologists are attending college for advanced or specialized training. Some college students preparing for careers in meteorology may obtain summer jobs with this agency. Promotions for regular full-time employees are made according to U.S Civil Service Commission regulations. (See chapter on Occupations in Government.)

Meteorologists in the Federal Government generally begin their careers in 2-year training positions at weather stations. Duties include making weather observations, briefing pilots, and disseminating weather forecasts. Advancement is to assistant forecaster, and forecaster.

Airline meteorologists have somewhat limited opportunities for advancement. However, after considerable work experience, they may advance to flight dispatcher or to various supervisory or administrative positions. A few well-trained meteorologists having a background in science, engineering, and business administration may establish their own weather consulting services.

Employment Outlook

The employment outlook for civilian meteorologists is expected to be favorable through the 1970's. In addition to job opportunities resulting from the rapid growth expected in this profession, several hundred new meteorologists will be needed each year to replace those who transfer to other fields, retire, or die.

Meteorologists having advanced degrees will be in demand to conduct research, teach in colleges and universities, and engage in management and consulting work. The advent of weather satellites, manned spacecraft, world-circling weather balloons, new international cooperative programs, and the use of electronic computers to make weather forecasts have expanded greatly the boundaries of meteorology. These advances have opened new fields of activity in the study of weather on a global scale. Meteorologists will be in demand to develop and improve instruments used to collect and process weather data.

Employment opportunities for meteorologists with commercial airlines, weather consulting services, and other private companies also are expected to increase, as the value of weather information to all segments of our economy receives further recognition. This recognition also may create opportunities in research positions with private research organizations and colleges and universities. The number of teaching positions for meteorologists also should rise, primarily because of anticipated increases in total college enrollments and in meteorology programs.

In addition, there will be a continuing demand for meteorologists to work in existing programs, such as weather measurements and forecasts, storm and flood forecasts, and research on the problems of severe storms, turbulence, and air pollution.

Earnings and Working Conditions

In 1970 meteorologists with the bachelor's degree and no experience could start in Federal Government service at $8,292 or $10,258 a year, depending on their college records. Meteorologists who had completed all requirements for the master's degree could start at $10,258 or $11,526; those having the Ph. D. degree could begin at $13,096 or $14,192. Workers stationed outside the United States were paid an additional amount. Employee benefits for Federal Government meteorologists were the same as for other civil service workers. (See chapter on Occupations in Government.)

Airline meteorologists received a starting salary ranging from $9,700 to $12,300 a year in 1970 according to the Air Transport Association. Meteorologists generally receive the same benefits as other airline employees. (See chapter on Occupations in Civil Aviation.)

According to the National Science Foundation's National Register of Scientific and Technical Personnel, the average (median) annual salary of meteorologists in 1970 was $15,200. Only 10 percent of the meteorologists earned less than $10,000 and about 10 percent earned more than $22,300.

Jobs in weather stations, which are operated on a 24-hour, 7-day week basis, often involve nightwork and rotating shifts. Most stations are at airports or at places in or near cities; some are in isolated and remote areas. Meteorologists generally work alone in smaller weather stations, and as part of a team in larger ones.

Sources of Additional Information

General information on career opportunities, educational facilities, and professional development in meteorology may be obtained from:

American Meteorological Society,
45 Beacon St., Boston, Mass. 02108.

American Geophysical Union, 2100
Pennsylvania Ave., NW., Washington, D.C. 20037.

Information on employment opportunities with the NOAA National Weather Service and on its student-assistance program may be obtained from:

Personnel Division AD42, National
Oceanic and Atmospheric Administration, 6010 Executive
Blvd., Rockville, Md. 20852.

Information on the Air Force meteorological training programs may be obtained from the nearest USAF recruiting office or from:

Commander, USAF Recruiting Service, Wright-Patterson AFB, Ohio
45899.

OCEANOGRAPHERS

(D.O.T. 024.081 and 041.081)

Nature of the Work

The ocean, which covers more than two-thirds of the earth's surface, provides man with valuable foods, fossil fuels, and minerals. It also influences the weather, serves as a "highway" for transportation, and offers many varieties of recreation. Oceanographers study the ocean—its characteristics, movements, physical properties, and plant and animal life. The results of their studies not only extend basic scientific knowledge but also contribute to development of practical methods for forecasting weather, fisheries development, mining ocean resources, and National defense.

Some oceanographers perform tests, make observations, and conduct surveys and experiments from ships or stationary platforms in the sea. They may collect and study data on the ocean's tides, currents, waves, mountain ranges and valleys. They also may study its temperature, density, and acoustical properties; its sediments; its sub-bottom; its shape; its interaction with the atmosphere; and marine plants and animals.

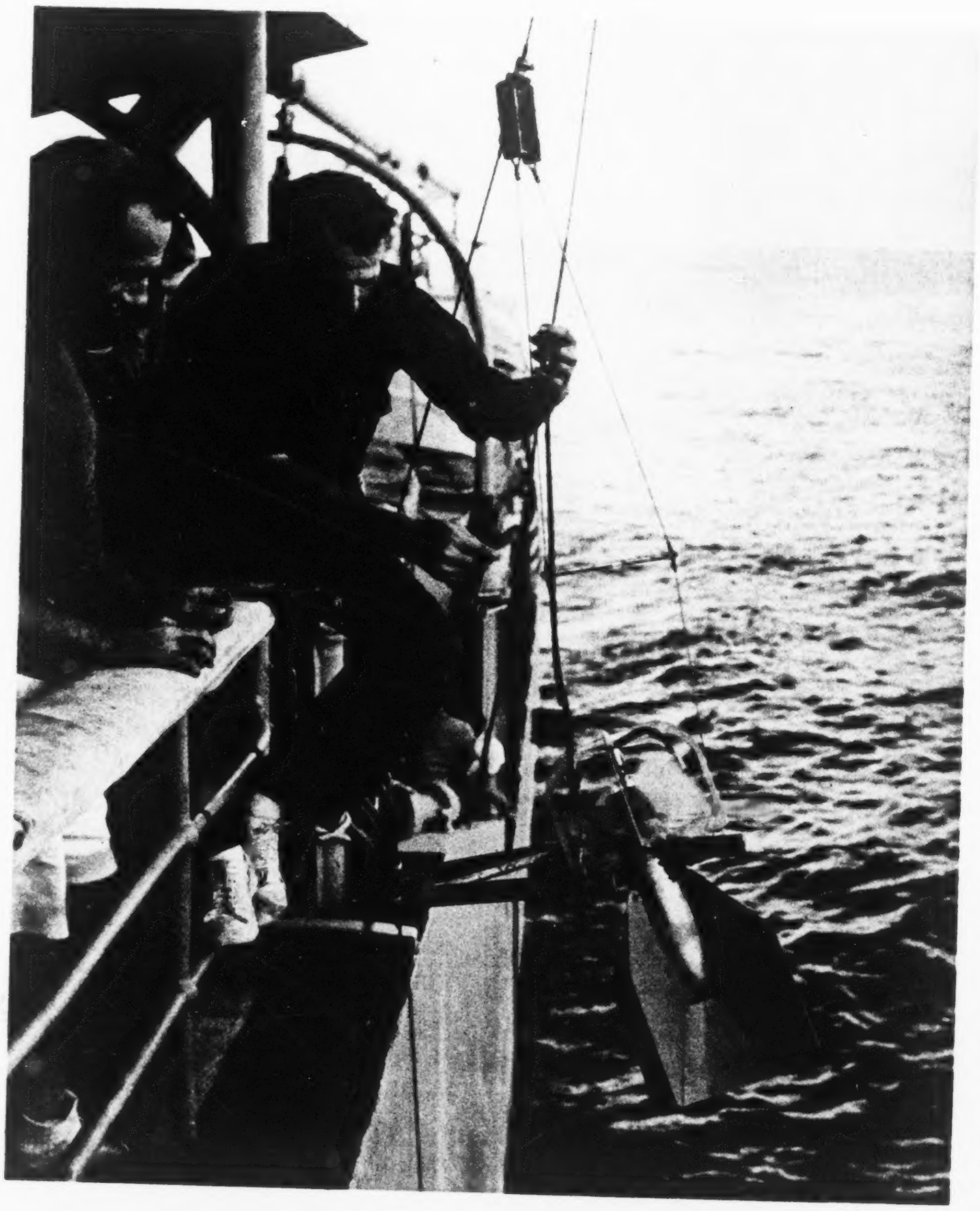
Other oceanographers perform equally important functions in laboratories on land. For instance, in some research laboratories, fish are measured and photographed, and their stomach contents analyzed; exotic sea specimens dissected, catalogued, and bottled; and plankton (floating microscopic plants and animals) identified, separated, and sometimes counted. At other laboratories, data collected from measuring and detecting devices are plotted on maps or fed to electronic computers to test theories such as sea-floor spreading and continental drift. To present the results of their studies, oceanographers prepare charts, tabulations, reports, and manuals, and write papers for scientific journals.

In developing and carrying out tests and observational programs, oceanographers use the principles and techniques of the natural sciences, mathematics, and engineering.

Current exploration techniques involve the use of instrumented probes from surface ships and low-flying aircraft. Oceanographers use instruments such as current meters that reveal the circulation of very deep water; echo sounders; the magnetometer and gravimeter that measure the earth's magnetic and gravity fields; heat probes that determine the flow of heat from the earth's interior; and sediment corers to extract samples from the ocean's floor. They also employ instruments to test temperature and chemical composition of the water. Specially developed cameras equipped with strong lights are used to photograph marine organisms and the ocean floor. Sounding devices are vital to the oceanographer for communicating with teammates above the water, and for measuring, mapping, and locating ocean materials.

Future oceanographers may rely on instrumented buoys to record data at all depths, satellites to observe the ocean's surface, and deep research vessels (DRV's)—small, versatile submersibles to provide "aquanauts" with a closer view of the underwater world.

Most oceanographers are specialists in one of the branches of the profession. *Biological oceanographers* (marine biologists) study the ocean's plant and animal life and the environmental conditions affecting them. For instance, they investigate marine animals that generate light and electricity (photoluminescence), study the effects of ocean organisms on manmade materials, search for ways to extract drugs from seaweeds or sponges, and determine the effects of radioactivity and pollution on the growth of fish. *Physical oceanographers* (physicists and geophysicists) study the physical properties of the ocean, such as its density, temperature, and ability to transmit light and sound; the movements of the sea; and the relationship between the sea and the atmosphere which may lead to control over the weather. *Geological oceanographers* (marine geologists) study the topographic features, rocks, and sediments of the ocean floor. They also help determine the location and availability of deposits of mineral, oil, and gas on the ocean floor. *Chemical oceanographers* investigate the chemical composition of ocean water and sediments, as well as chemical reactions that occur in the sea. For example, they are concerned with processes such as desalination (removing salt from sea water). *Marine meteorologists* study the interaction of the atmosphere and the ocean, and the processes by which weather over the ocean is generated. *Oceanographic engineers* and *electronic specialists*



Oceanographer lowers current meter to study circulation of deep waters.

design and build the systems, devices, and instruments used in oceanographic research and operations. Other tasks include laying cables, supervising underwater construction, and locating sunken ships and recovering their cargos.

About 3 out of 4 oceanographers are engaged primarily in performing or administering research and development activities. A number teach in colleges and universities; a few are engaged in technical writing or consulting and in the administration of activities other than research.

Places of Employment

An estimated 5,400 oceanographers and closely related technical personnel were employed in the United States in 1970. About four-fifths were employed by the Federal Government and colleges and universities. Those Federal agencies employing substantial numbers of oceanographers were the Naval Oceanographic Office, and the National Oceanic and Atmospheric Administration (NOAA), a newly created agency combining several Federal oceanographic-related offices such as the Bureau of Commercial Fisheries, and the Environmental Science Services Administration.

A number of oceanographers work in private industry for firms that design and develop instruments and vehicles for oceanographic research. A few work for fishery laboratories of State and local governments.

Training, Other Qualifications, and Advancement

The minimum educational requirement for beginning professional positions in oceanography is the bachelor's degree with a major in oceanography, biology, a geo-science, one of the other basic sciences, mathematics, or engineering. To qualify for professional positions in research and teaching as well as for advancement to high-level positions in most types of work, graduate training in oceanography or one of the basic sciences usually is required.

Undergraduate training in oceanography, marine science, ocean engineering, or fisheries was offered by only about 24 colleges and universities in 1970. Only nine institutions offered the bachelor's degree with a major in oceanography. However, since oceanography is an interdisciplinary field, training in the related basic sciences, when coupled with a strong interest in oceanography, is adequate preparation for most beginning positions or for entry into graduate school.

Important undergraduate courses for the prospective oceanographer are in the fields of mathematics, physics, chemistry, geophysics, geology, meteorology, and biology. In general, the student should specialize in the particular science field which is closest to his area of interest in oceanography. For example, students interested in chemical oceanography should obtain a degree in chemistry.

In 1970 about 22 colleges and universities offered advanced degrees in oceanography, and about 21 other institutions offered advanced courses in fisheries, marine science, or oceanographic engineering. The academic work of the graduate student in oceanography consists primarily of extensive training in a basic science combined with further training in oceanography. The graduate student usually works part of the time aboard ship, doing oceanographic research for his dissertation and acquiring familiarity with the sea and techniques used to obtain oceanographic information. A variety of summer courses is offered also by universities at the various marine stations along our coasts. These are intended for both undergraduate and graduate students and are recommended particularly for students from inland universities.

The beginning oceanographer with the bachelor's degree usually starts as a research or laboratory assistant, or in routine data collection, analysis, or computation. Most new oceanographers receive on-the-job training related to the specific work at hand. The nature and extent of the training vary with the background and needs of the individual. Thus, the new graduate who has a degree in a basic science rather than in oceanography usually can be provided enough understanding of oceanographic principles to enable him to perform adequately in this field.

Beginning oceanographers having advanced degrees usually can qualify for research and teaching positions. Experienced oceanographers may be selected for administrative positions in which they may supervise a research laboratory or direct specific survey or research projects.

Most oceanographers work part of the time aboard oceanographic ships at sea. These voyages may last from a few days to several months. A few oceanographers work nearly all of the time aboard ship. On the other hand, some oceanographers never go to sea; they analyze data collected by other scientists or pursue mathematical or theoretical studies ashore.

Employment Outlook

Employment opportunities for those having advanced degrees in oceanography—especially the Ph. D. degree—are expected to be favorable through the 1970's. Well-trained persons with bachelor's degrees in oceanography and related sciences will find opportunities mainly as research assistants in routine analytical positions.

The outlook is for very rapid growth in this profession through the 1970's. Growing recognition of the importance of the oceans to the Nation's welfare and security has heightened interest in oceanography and has opened new fields for specialists. In the years ahead, improving the Nation's defenses against submarines and surface vessels will require oceanographic research into underwater sound, surface and subsurface currents, and configuration of the ocean's floor. Oceanographers will be needed too for weather and iceberg forecasting and to study air-sea interaction in long-range forecasts. They will be needed to develop new technologies for discovering and mining the fuel and mineral resources of the ocean's floor, and to protect waters from damage by pollution and land from damage by waves and tides. Other oceanographers may improve methods of taking foods and pharmaceuticals from the oceans, manage fisheries, and develop economical means of harnessing the ocean for energy and of providing fresh water from the sea.

The demand for oceanographers qualified to teach in colleges and universities also is expected to expand. As interest in oceanography grows and more courses in oceanography are offered, more teachers in the science will be needed.

Replacement of oceanographers who transfer to other fields, retire, or die also will provide some opportunities.

Since oceanography is a relatively small profession, job openings will not be numerous in any 1 year. On the other hand, the number of new graduates having advanced degrees in this science is small and is expected to remain so. As a result, these new oceanography graduates should continue to have favorable employment opportunities.

Earnings and Working Conditions

In the Federal Government service in 1970, oceanographers having the bachelor's degree and no experience could begin at $8,292 or $10,258 a year, depending on their college records. Beginning oceanographers who had completed all requirements for the master's degree could start at $10,258 or $11,526; those having the Ph. D. degree could begin at $13,096 or $14,192. Scientists in geological and biological specialties had somewhat lower starting salaries.

In private industry in 1970, new graduates having bachelor's degrees received median starting salaries of $8,650 a year, according to a salary survey conducted by the American Geological Institute. New graduates having master's degrees averaged $10,500 a year, and those holding doctor's degrees averaged $12,000 a year to start in 1970. According to the National Science Foundation's National Register of Scientific and Technical Personnel, the average (median) annual salary of earth scientists in 1970 was $14,900. Only 10 percent of the earth scientists earned less than $10,000 and about 10 percent earned more than $23,100.

Beginning oceanographers in educational institutions receive the same salary as other beginning faculty members. (See statement on "College and University Teachers.") In addition to their regular salaries, many experienced oceanographers in educational institutions earn extra income from consulting, lecturing, and writing activities.

Oceanographers engaged in research requiring sea voyages are frequently away from home for weeks or months at a time, sometimes living and working in cramped quarters. Young persons who like the sea, however, may find these voyages very satisfying.

Sources of Additional Information

General information about oceanography—including career opportunities, professional training, colleges and universities having applicable degree-credit programs, earnings, and the economic significance of oceanographic activities—may be obtained from:

International Oceanographic Foundation, 1 Rickenbacker Causeway, Virginia Key, Miami, Fla. 33149.

National Oceanography Association, 1900 L St. NW., Washington, D.C. 20036.

National Oceanic and Atmospheric Administration, Room 218, Bldg. 5, 6010 Executive Blvd., Rockville, Maryland 20852.

Federal Government career information may be obtained from any regional office of the U.S. Civil Service Commission or from:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20415.

The bulletin *University Curricula in the Marine Sciences and Related Fields* may be obtained from:

Marine Sciences Affairs Staff, Bldg.

159E, Rm. 476, Washington Navy Yard, Washington, D.C. 20390.

The booklet, *Oceanography Information Sources '70,* lists the names and addresses of industrial organizations involved in oceanography and publishers of oceanographic educational materials, journals, and periodicals. Copies may be purchased from:

Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Ave. NW., Washington, D.C. 20418.

The bulletin, *Marine Science Affairs—Selecting Priority Programs (April 1970),* contains information on the national oceanography program. Copies may be obtained from:

Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

Some information on oceanographic specialties may be obtained from professional societies listed elsewhere in the *Handbook.* (See statements on Geologists, Geophysicists, Life Scientists, Meteorologists, and Chemists.)

Life Science Occupations

Life scientists study all living organisms and the processes that determine the nature of life. They are concerned with men and microbes, plants and animals, and health and disease, as well as how these organisms relate to their environment.

Some scientists in these fields perform research to expand our understandings of living things. Others, who teach, pass this knowledge on to students. Many scientists pursue both activities. Still others apply scientific concepts and principles to the solution of practical problems, such as the development of new drugs or varieties of plants, and seek solutions to problems of pollution.

This chapter discusses life scientists as a group since they receive comparable basic training and have similar employment and earning prospects. Brief descriptions are provided about the nature of the work of a number of life scientists—including botanists, zoologists, microbiologists, biophysicists, ecologists, pathologists, and pharmacologists. This chapter also contains a separate statement on biochemists. More detailed statements for other professional workers in the life sciences—soil scientists, soil conservationists, foresters, and range managers—are discussed elsewhere in the *Handbook.*

LIFE SCIENTISTS

(D.O.T. 040.081, 041.081, 070.081, and 077.128)

Nature of the Work

Life scientists study living organisms, their structure, evolutionary development, behavior, and life processes. They emphasize the relationship between animals, plants, and micro-organisms and their environments. The number and variety of plants and animals are so vast and the life processes so varied and complex that life scientists must specialize in one of three broad areas—agriculture, biology, medicine.

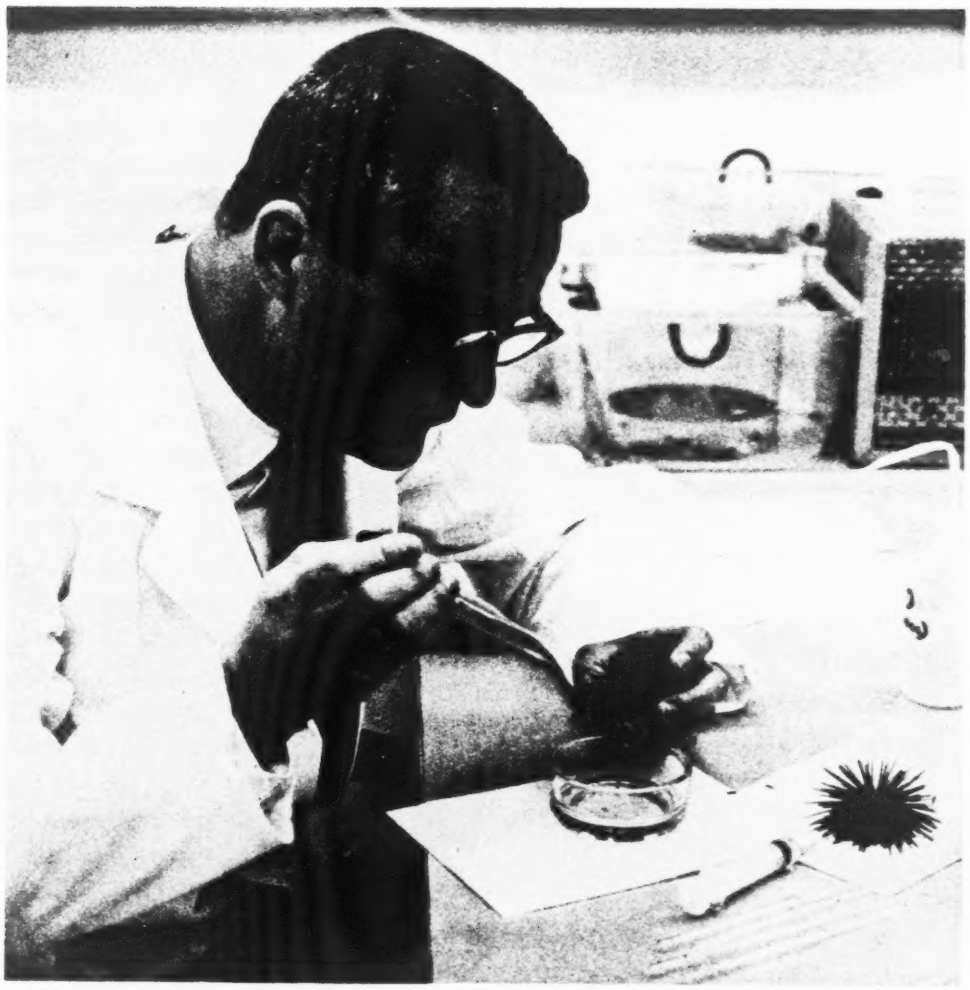
Two-fifths of all life scientists are engaged in research and development. Many conduct basic research, which is aimed at adding to our knowledge of living organisms with only secondary regard to its application. Nevertheless, the development of insecticides, disease-resistant crops, and antibiotics have resulted from this type of research.

Research in the life sciences may take many forms. A botanist exploring the volcanic Alaskan valleys to see what plants live in this strange environment and a zoologist searching the jungles of the Amazon valley for previously unknown kinds of animals are both doing research; likewise, an entomologist in a laboratory tests various chemical insecticides for effectiveness and possible hazards to human and animal life.

Life scientists must be familiar with fundamental research techniques and the use of light and electron microscopes and other complex laboratory equipment. Advanced techniques and principles from chemistry and physics are applied widely. Knowledge of mathematical and statistical procedures, as well as of the operation of electronic computers, often is needed in experiments.

Teaching in a college or university is the major function of nearly one-fourth of all life scientists. Many teachers combine independent research with their regular teaching duties, and in some large educational institutions, use the major portion of their time on research.

More than one-fourth of all life scientists are engaged in management and administrative work, primarily the planning, supervision, and administration of programs of research or testing of foods, drugs, and other products. Others provide liaison between the Federal Gov-



Life scientist induces sea urchin to shed eggs for experiment.

ernment and the agricultural experiment stations at State universities, assisting in the planning, development, and evaluation of research programs at these stations.

The remaining life scientists are engaged in a variety of other types of work, such as consulting, writing, testing, and inspection. A few are employed in technical sales or field service work for industrial firms; such work may include, for example, teaching company salesmen and prospective purchasers the value and proper use of new chemicals. Some are engaged in research in natural history museums, zoos, and botanical gardens.

Life scientists may be classified into three broad groups characterized by the general type of organism with which they work: Botanists, who study plants; zoologists, who are concerned with animals; and microbiologists, who work with microorganisms.

Botanists study all aspects of plant life. Plant taxonomists identify and classify plants. Plant ecologists study the interrelationships between environmental elements and plant life and distribution. Other botanists include plant morphologists, concerned with the structure of plants and plant cells; plant physiologists, interested in the life processes of plants; and plant pathologists, engaged in determining the cause and control of plant diseases.

Zoologists study animal life—its origin, classification, behavior, life processes, diseases, and parasites—and the ways in which animals influence and are influenced by their environment. Some zoologists conduct experimental studies with live animals, and in some cases, study them in their natural environment. Others work mainly in laboratories dissecting animals and examining them under the microscope. Zoologists who specialize in the study of certain classes of animals may use titles that indicate the kind of animal studied, such as ornithologists (birds), herpetologists (reptiles and amphibians), ichthyologists (fishes), and mammalogists (mammals).

Microbiologists investigate the growth, structure, and general characteristics of bacteria, viruses, molds, and other organisms of microscopic or submicroscopic size. Although the terms bacteriology and microbiology are sometimes used interchangeably, microbiology, the broader term, is preferable when referring to the study of all microscopic organisms. Microbiologists isolate and make cultures of these organisms in order to examine them with a variety of highly specialized equipment. Some microbiologists pursue medical problems, such as the relationship between bacteria and infectious disease, or the effect of antibiotics on bacteria. Others specialize in soil bacteriology (the study of soil microorganisms and their relation to soil fertility), virology (the study of viruses), immunology (the study of the mechanisms that fight infection), or serology (the study of animal and plant fluids, including blood serums).

Life scientists also may be classified according to the type of approach used—some of which are wholly within 1 of the 3 major groupings, and others which may be found in all 3 groups. Some life scientists are classified according to the specific type of organism studied. Some life scientists whose work cuts across more than one of these major groupings, as often in the case of college and university teachers, simply may call themselves biologists. A description of the work of some life scientists follows.

Agronomists are concerned with improving crops and the soil. Those working with the soil analyze it, map the soils of an area, or develop and apply new methods for increasing acreage yields. They also study ways to conserve water and to decrease erosion. Agronomists involved in crop science develop new methods of growing crops for improved quality, higher yield, and more efficient production. They seek new, hardier varieties of crops and better methods of controlling disease, pests, and weeds.

Anatomists study the form and structure of organisms. Those who specialize in the structure of cells are known as cytologists, whereas those who specialize in the structure of tissues and organs are known as histologists. Anatomists may examine structures visible to the naked eye or of microscopic size, or those of submicroscopic size, visible only through the use of the electron microscope. Many anatomists specialize in human anatomy.

Biochemists, who are trained in both chemistry and biology, study the chemical processes of living things. A more detailed description of their work is contained in a separate statement elsewhere in this chapter.

Biological oceanographers, or marine biologists, study the plant and animal life in the oceans and the environmental conditions affecting them. (See separate statement on Oceanographers elsewhere in the *Handbook.*)

Biophysicists who are trained in both physics and biology, investigate the physical principles of living cells and organisms, and their responses to physical forces, such as heat, light, radiation, sound, and electricity. They may use the electron microscope to make tissues visible down to the smallest units and they may use nuclear reactors to study the effect of radiation on cells and tissues.

Ecologists study the mutual relationship among organisms and between them and their environment. They are interested in the effects of environmental influences such as rainfall, temperature, and altitude on these organisms. For instance, ecologists extract samples of phytoplankton, microscopic plants which produce most of the world's atmospheric oxygen, from bodies of water to determine the effects of pollution on their growth, or measure the radioactive content of fish by tracing tagged elements as they pass through their systems.

Embryologists study the development of an organism from fertilization of the egg through the hatching process or gestation period. They investigate the physiological, biochemical, and genetic mechanisms that control and direct the processes of development, how and why this control is accomplished, and the causes of abnormalities in development.

Entomologists are concerned with insects and their relation to plant and animal life. They identify and classify the enormous number of different kinds of insects. Some entomologists seek to control harmful insects through the use of chemicals, predatory birds, or other methods. Others develop ways to encourage the growth and spread of beneficial insects, such as honeybees.

Geneticists explore the origin, transmission, and development of hereditary characteristics. Geneticists engaged primarily in improving plant and animal breeds of economic importance—such as cereal and tobacco crops or dairy cattle and poultry—may be classified as plant or animal breeders, agronomists, or animal science specialists. Theoretical geneticists search for the mechanisms that determine inherited traits in plants, animals, or humans.

Horticulturists work with orchard and garden plants, such as fruits, nuts, vegetables, flowers and ornamental plants, and other nursery stocks. They develop new or improved plant varieties and better methods of growing, harvesting, storing, and transporting horticultural crops. Horticulturists usually specialize in either a specific plant or a particular technical problem, such as plant breeding.

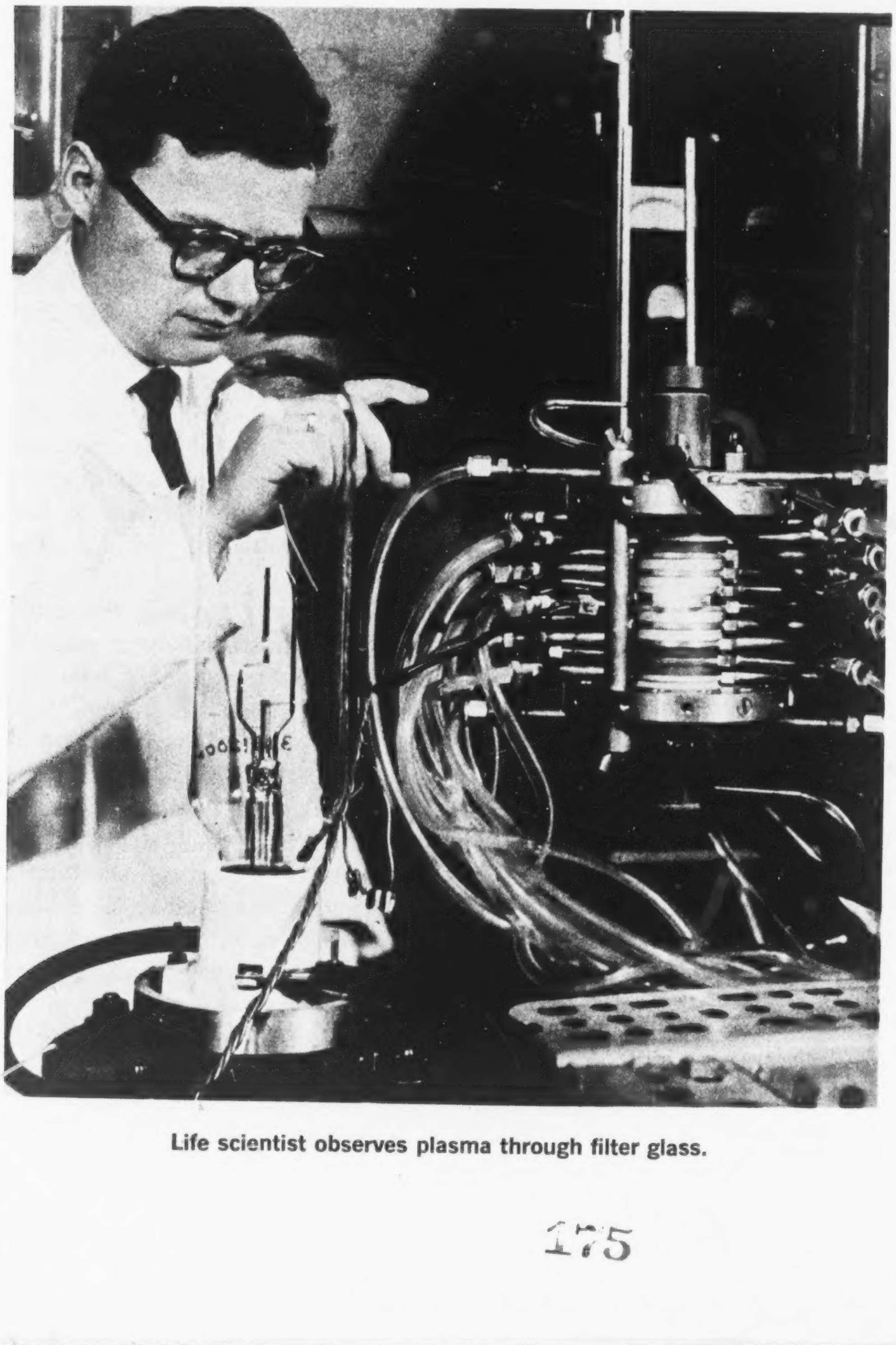
Husbandry specialists (animal) conduct research on the breeding, feeding, management, and diseases of domestic farm animals to improve the health and yield of these animals.

Nutritionists examime the processes through which food is utilized, the kinds and quantities of food elements—such as minerals, fats, sugars, vitamins, and proteins—that are essential to build and repair body tissues and maintain health, and how these food elements are transformed into body substances and energy. Nutritionists also analyze food to determine its composition in terms of essential ingredients or nutrients.

Pathologists study the nature, cause, and development of disease, degeneration, and abnormal functioning in humans, in animals or in plants. Many specialize in the study of the effects of diseases, parasites, and insect pests on cells, tissues, and organs. Others investigate genetic variations and other abnormal effects caused by drugs. The term "pathologist" is normally reserved for specialists in human pathology (medical pathology). Specialists in animal pathology are usually veterinarians. (See statement on Veterinarians.) Those who study plant diseases may be called plant pathologists or phytopathologists; their work is discussed under the section on botanists.

Pharmacologists conduct tests with animals such as rats, guinea pigs, and monkeys to determine the effects of drugs, gases, poisons, dusts, and other substances on the functioning of tissues and organs, and relate their findings with medical data. They may develop new or improved chemical compounds for use in drugs and medicines.

Physiologists study the structure and functions of cells, tissues, and organs and the effects of environmental factors on life processes. They may specialize in cellular activities or in one of the organ systems, such as the digestive, nervous, circulatory, or reproductive systems. The knowledge gained in such research often provides the basis for the work of many other specialists, such as biochemists, pathologists, pharmacologists, or nutritionists.



Life scientist observes plasma through filter glass.

Places of Employment

An estimated 180,000 persons were employed in the life sciences in 1970. About 10 percent were women. Of this total, nearly 48,000 worked in agricultural science, more than 71,000 worked in biological science, and about 61,000 worked on problems related to medical science.

Nearly three-fifths of the total were employed by colleges and universities in teaching and research positions. Medical schools and their associated hospitals employed particularly large numbers of life scientists in the medical field. State agricultural colleges and agricultural experiment stations operated by universities in cooperation with Federal and State Governments employed sizable numbers of agronomists, horticulturists, animal husbandry specialists, entomologists, and other agriculture-related specialists.

The Federal Government in 1970 employed more than 25,000 life scientists, two-thirds of whom were employed in the Department of Agriculture. The Department of the Interior employed nearly all the fish and wildlife biologists in the Federal Government. Other large numbers of life scientists were employed by the Department of the Army and the National Institutes of Health.

State and local governments, combined, employed about 21,000 biologists—mostly fish and wildlife specialists, microbiologists, and entomologists—for work in conservation, detection and control of diseases, and plant breeding.

Approximately 26,000 life scientists worked for private industry in 1970. Among the major industrial employers were manufacturers of pharmaceuticals, industrial chemicals, and food products. A few were self-employed. More than 5,000 life scientists worked for privately financed research organizations and other nonprofit foundations.

Although life scientists were employed in all States, nearly one-third were located in five States—California, New York, Pennsylvania, Illinois, and Maryland. More than one-tenth of all life scientists were located in only two metropolitan areas—Washington, D.C., and New York, N.Y.

Training, Other Qualifications, and Advancement

Young people seeking professional careers in the life sciences should plan to obtain an advanced degree—preferably a Ph. D.—in their field of interest. The bachelor's degree with a major in one of the life sciences may be adequate preparation for some beginning jobs, but promotional opportunities for those without graduate training are generally limited to intermediate level positions.

The Ph. D. degree generally is required for higher level college teaching positions and for independent research. It is also necessary for many positions involving the administration of research programs.

New graduates having a master's degree may qualify for most entry positions in applied research and for some types of positions in college teaching.

Those having a bachelor's degree may qualify for positions involving testing, production and operation work, technical sales and service, and duties connected with the enforcement of government regulations. They also may obtain positions as advanced technicians, particularly in the medical area. Some graduates having a bachelor's degree may take courses in education and choose a career as a high school teacher of biology rather than one as a life scientist. (See statement on Secondary School Teachers.)

Training leading to a bachelor's degree with a major in one of the life science specialties is offered by nearly all colleges and universities. Courses differ greatly from one college to another, and it is important that a student determine which college program best fits his interests and needs. In general, liberal arts colleges and universities emphasize training in the biological sciences and medical research. State universities and land-grant colleges offer special advantages to those interested in agricultural sciences because their agricultural experiment stations provide many opportunities for practical training and research work.

Prospective life scientists should obtain the broadest undergraduate training possible in all branches of biology and in related sciences, particularly biochemistry, organic and inorganic chemistry, physics, and mathematics. Courses in statistics, calculus, biometrics and computer programming analysis are becoming increasingly essential. Training and practice in laboratory techniques, in the use of laboratory equipment, and in fieldwork are also important.

Advanced degrees in the life sciences also are conferred by a large number of colleges and universities. Requirements for advanced degrees usually include fieldwork and laboratory research, as well as classroom studies and preparation of a thesis.

Young people planning careers as life scientists should be able to work independently, or as part of a team. The ability to express oneself both orally and in writing also is important. Physical stamina and an inquiring mind are necessary for those interested in research in remote places.

Employment Outlook

Employment in the life sciences is expected to increase rapidly through the 1970's. In addition to those needed to fill openings resulting from growth, thousands of life scientists will be needed to replace those who transfer to other fields of work, die, or retire. However, along with the growing number of job openings, the number of life science graduates also is projected to increase rapidly. As a result, keen competition is expected for the more desirable positions. Those holding advanced degrees, especially the Ph. D., should experience less competion than bachelor's degree recipients for jobs. Opportunities for those holding only undergraduate degrees will probably be limited to research assistant or technician positions.

One of the major factors which will tend to increase the employment of life scientists is the anticipated continued growth in research and development, particularly in medical research programs sponsored by the Federal Government and voluntary health agencies. For example, the Federal Government is expected to allocate additional millions of dollars for cancer research during the next few years. Other areas of concentrated medical study include heart disease and birth defects. Research in such relatively new areas as space biology, radiation biology, environmental health, biological oceanography, and genetic regulation also will probably increase.

Industry also is expected to increase its spending for research and development in the biological sciences. Furthermore, the stringent health standards of the Federal regulatory agencies are likely to result in a heightened demand for additional life scientists in industry to perform research and testing before new drugs, chemicals, and processing methods are made available to the public.

Another factor which should increase employment of life scientists is the substantially larger college and university enrollments expected during the 1970's. Although the resulting rise in demand for teachers will be to a large extent for Ph. D.'s, there may be some openings for qualified people holding master's degrees, especially in community colleges.

Earnings and Working Conditions

In the Federal Government in 1970, life scientists having a bachelor's degree could begin at $6,548 or $8,098 a year, depending on their college records. Beginning life scientists having the master's degree could start at $8,098 or $9,881, depending upon their academic records. Those having the Ph. D. degree could begin at $11,905 or $14,192.

Life scientists in colleges and universities earned median salaries between $15,800 and $16,500 a year in 1970, according to the limited information available. (For further information, see statement on College and University Teachers.) Life scientists in educational institutions sometimes supplement their regular salaries with income from writing, consulting, and special research projects.

According to the National Science Foundation's Register of Scientific and Technical Personnel, agricultural scientists earned about $12,800 a year in 1970; about 10 percent received less than $8,800 a year, while 10 percent earned at least $19,500. The average (median) annual salary for biological scientists was $15,000 in 1970, according to the Register; only 10 percent earned less than $8,700 a year, and about 10 percent earned $26,100 or more. In general, life scientists in private industry tend to have higher salaries than those in either colleges and universities or Government employment.

Sources of Additional Information

General information on careers in the life sciences may be obtained from:

American Institute of Biological Sciences, 3900 Wisconsin Ave. NW., Washington, D.C. 20016.

American Society of Horticultural Science, 615 Elm Street, St. Joseph, Michigan 49085.

American Physiological Society, 9650 Rockville Pike, Bethesda, Maryland 20014.

Ecological Society of America, Connecticut College, New London, Connecticut 06320.

Specific information on Federal Government careers may be obtained from:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20415.

BIOCHEMISTS

(D.O.T. 041.081)

Nature of the Work

The biochemist has an important role in modern science's search for the basis of life and the factors that sustain it. His professional interests range from what determines heredity to how living things react to space travel.

Biochemists study the chemical composition of living organisms. They identify and analyze the chemical processes related to biological functions, such as muscular contraction, reproduction, and metabolism. Biochemists investigate the effects on organisms of such chemical substances as foods, hormones, and drugs. They study the chemical changes in living tissue caused by genetic and environmental factors.

Biochemists study a wide variety of substances, ranging from very small molecules to giant macromolecules. They analyze chemical compounds such as minerals and sugars. Biochemists deal with problems in genetics, enzymology, hormone action, bioenergetics, and the phenomena of biochemical control.

Foremost among the areas of application of biochemistry are medicine, biomedicine, nutrition, and agriculture. In the medical field, biochemists may investigate the causes and cures of disease or develop diagnostic procedures. In the biomedical area, they contribute to our understanding of genetics, he-

Biologist isolates granules from heart tissue.

redity, brain function, and physiological adaptation. In the nutritional field, they may identify the nutrients necessary to maintain good health and the effects of specific deficiencies on various kinds of performance, including the ability to learn. In agriculture, biochemists investigate soils, fertilizers, and plants, and undertake studies to discover more efficient methods of crop cultivation, storage, and utilization, and the design and use of pest-control agents.

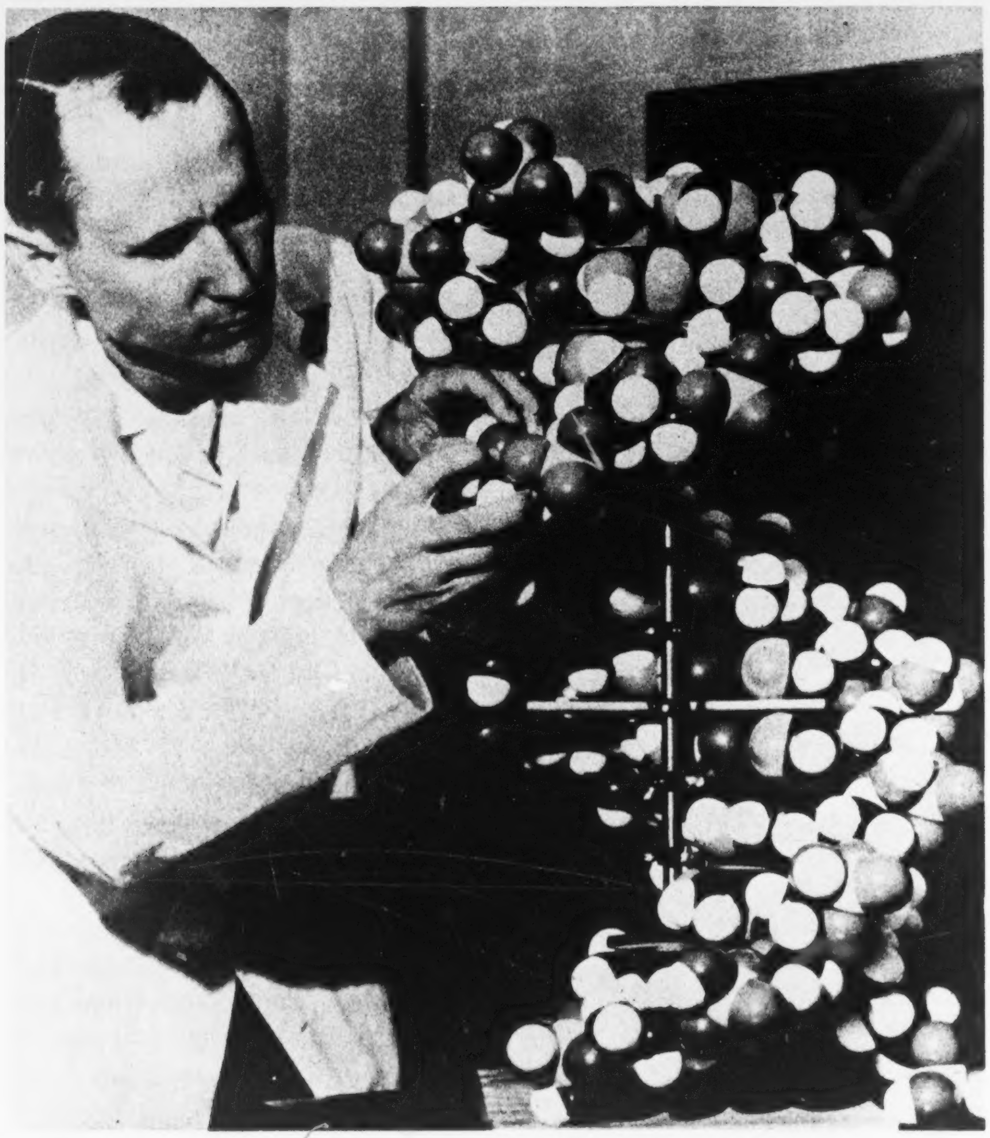
Biochemists apply the principles and procedures of chemical and physical analysis to their research problems. Routine laboratory tasks include weighing, filtering, distilling, drying, and culturing substances or materials. Some experiments require more sophisticated tasks such as designing and constructing chemical apparatus or performing tests using radioactive tracers. Biochemists use a variety of instruments including electron microscopes and radioactive isotope counters, and devise new instruments and analytical techniques as needed. They usually report the results of their research in scientific journals and sometimes lecture before scientific groups.

More than 3 out of 4 biochemists are engaged in research. The vast majority pursue basic research. A small group working in applied research use the discoveries of basic research to solve practical problems or develop useful products. For example, through basic research, biochemists discover how a living organism forms a hormone. This knowledge is put to use by synthesizing the hormone in the laboratory and then producing it on a mass scale to enrich hormone-deficient organisms. The distinction between basic and applied research, however, is often one of degree; biochemists may engage in both types of work.

Some biochemists combine research with teaching in colleges and universities. Small proportions are engaged in production and testing activities or private consulting.

Places of Employment

Approximately 11,000 biochemists were employed in the United States in 1970. The number of women in biochemistry is not known. However, almost one-third of all advanced degrees in biochemistry in recent years have been awarded to women. More than half of all biochemists were employed by colleges and universities in 1970. Many of these scientists were teaching and performing research in university-operated laboratories and hospitals. Another 700 biochemists worked for nonprofit organizations, such as research institutes and foundations.



Biochemist constructs molecular model.

Private industry employed more than one-fifth of all biochemists. The largest group of these worked in the chemical industry, primarily for manufacturers of drugs, insecticides, and cosmetics.

Several thousand biochemists worked for Federal, State, and local government agencies. Most of these scientists were employed by Federal agencies concerned with health or agriculture.

Training, Other Qualifications, and Advancement

The minimum educational requirement for beginning positions in biochemistry is the bachelor's degree with a major in biochemistry or chemistry, or with a major in biology and a minor in chemistry. For most entrance positions in research and teaching, graduate training in biochemistry is required. Graduate work also is needed for advancement to most high-level positions in all types of work.

Approximately 40 schools award the bachelor's degree in biochemistry. However, nearly all colleges and universities offer a major in biology or chemistry. The prospective biochemist should take undergraduate courses in chemistry, biology, biochemistry, mathematics, and physics.

More than 100 colleges and universities offer graduate degrees in biochemistry. For entrance into a graduate program, schools usually require the student to have a bachelor's degree in biochemistry, biology, or chemistry. However, students who have the bachelor's degree in another basic science but who have had several undergraduate courses in chemistry usually are admitted.

In graduate school, the student builds upon the basic knowledge obtained in the undergraduate curriculum. He takes advanced courses and conducts research in many areas of biochemistry. For the doctoral degree, he usually specializes in a particular field of biochemistry by doing intensive research and writing a thesis.

Some graduate schools have a reputation for training students in a particular field of biochemistry. For example, a university affiliated with a medical school or hospital often has the facilities and equipment available to study the biochemistry of disease. Therefore, a student who desires to specialize should investigate the specialties of the various schools and make his selection carefully.

New graduates having the bachelor's degree usually begin work as research assistants. These positions involve testing and analysis. In the drug industry, for example, research assistants analyze the ingredients of a product to verify and maintain its purity or quality. Some graduate students become research or teaching assistants in colleges and universities.

Beginning biochemists having advanced degrees usually qualify for research or teaching positions.

Some experienced biochemists who have Ph. D. degrees advance to high-level administrative positions and supervise research programs. Other highly qualified biochemists, who prefer to devote their time to research, often become leaders in a particular field of biochemistry.

Young people planning careers as biochemists should be able to work independently or as part of a team. Preciseness, keen powers of observation, and mechanical aptitude also are important. Prospective biochemists should have analytical and curious minds while possessing the patience and perseverance needed to complete hundreds of experiments to solve one problem.

Employment Outlook

The employment outlook is likely to be good for biochemists through the 1970's. In addition to new opportunities resulting from the very rapid growth expected in this field, several hundred will be needed each year to replace workers who transfer to other fields of work, retire, or die.

Although biochemistry is a relatively small profession and job openings will not be numerous in any one year, the number of graduates who have degrees in this science also is fairly small and is expected to remain so. Thus, the employment outlook should continue to be favorable for biochemistry graduates.

The greatest demand will be for the biochemist who has the Ph. D. degree, to conduct independent research or to teach.

The major factor underlying the anticipated growth is the continued increase in expenditures for research and development in life sciences.

The greatest growth in employment of biochemists is expected in expanding areas of medical research. For instance, the Federal Government is expected to allocate millions of dollars for cancer research during the next few years. Other areas of concentrated medical study include heart disease, muscular dystrophy, and mental illness. Also, an increasing number of biochemists will be needed to work in clinical laboratories associated with hospitals. Additional biochemists will be needed to implement the more stringent drug standards that have been established by Congress and the Federal regulatory agencies. Biochemistry also is becoming important in other fields, such as environmental studies.

Growing college enrollments, especially of students majoring in chemistry and the life sciences, will strengthen the demand for biochemists qualified to teach in colleges and universities.

Earnings and Working Conditions

Starting salaries paid to biochemists employed by colleges and universities are comparable to those for other professional faculty members. Biochemists in educational institutions often supplement their income by engaging in outside research or consulting work.

In 1970, the average (median) earnings for all biochemists who had a bachelor's degree was $10,800; for those having a master's degree, $12,500; and for those having a Ph. D., $15,800.

Sources of Additional Information

General information on careers in biochemistry may be obtained from:

American Society of Biological Chemists, 9650 Rockville Pike,
Bethesda, Md. 20014.

Physical Scientists

The physical sciences deal with the basic laws of the physical world. Many physical scientists conduct basic research designed to increase man's knowledge of the properties of matter and energy. Others conduct applied research and use the knowledge gained from basic research to develop new products and processes. For example, chemists in applied research use their knowledge of the interactions of various chemicals to develop new fuels for rockets and missiles. Physical scientists also teach in colleges and universities and supervise research and development programs.

This chapter describes three major physical science occupations—chemist, physicist, and astronomer—and food scientists, who apply scientific principles to the processing of food. Engineers, life scientists, and earth scientists also require a background in the physical sciences; these occupations are described in separate chapters elsewhere in the *Handbook*.

CHEMISTS

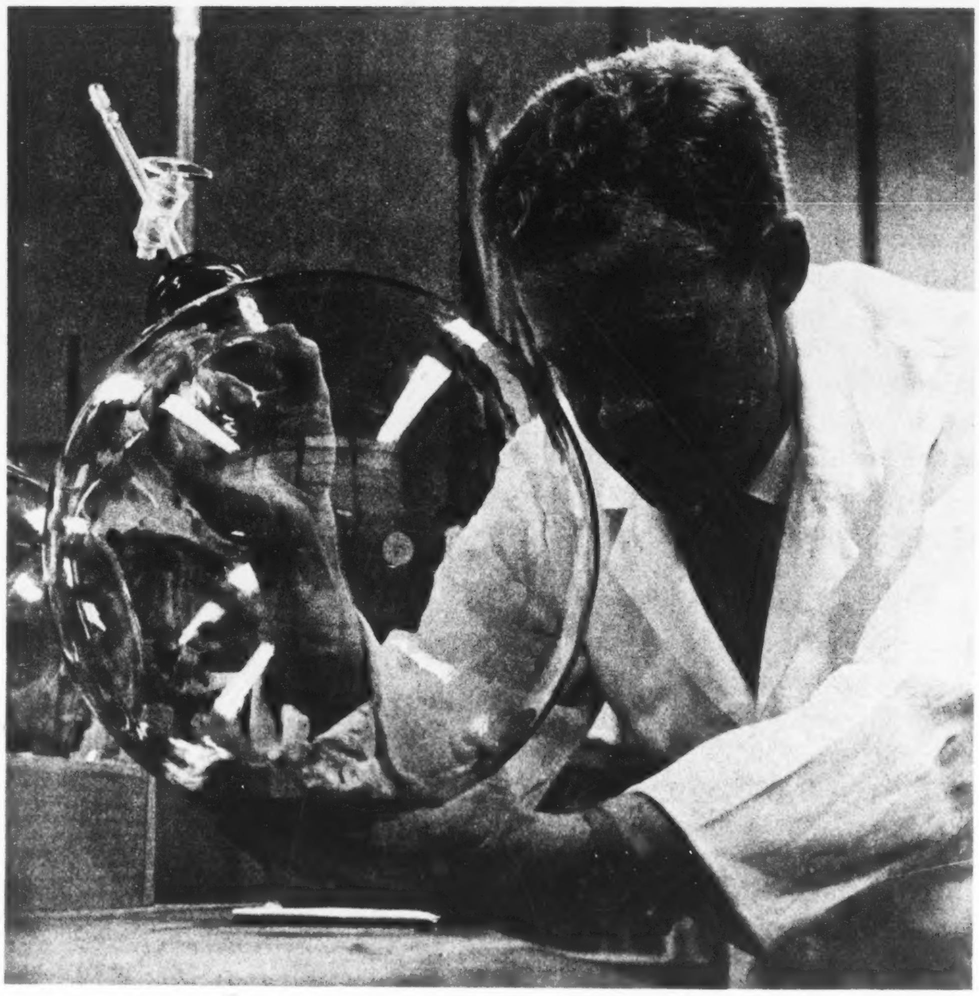
(D.O.T. 022.081, .168, .181, and .281)

Nature of the Work

The clothes we wear, the food we eat, the houses in which we live—in fact, most of the things which help to make our lives more comfortable, healthy, and productive—have resulted, in part, from the chemist's continuing search for new knowledge. Although the day-to-day activities of chemists generally receive little notice, some of their discoveries have led to the creation of whole new industries, such as the plastics, frozen foods, and manmade fibers industries.

Chemists investigate the properties and composition of matter, and the laws that govern the combination of elements in a seemingly endless variety of forms. They search for new knowledge about substances and try to utilize this knowledge for practical use. In conducting studies, they apply scientific principles and techniques and use a variety of specialized instruments to measure, identify, and evaluate changes in matter. Chemists maintain accurate records of their work and prepare clear and concise reports showing results of tests or experiments. They often present their findings in scientific publications or in lectures before scientific groups.

The activities of chemists are varied. Some chemists develop new substances such as rocket fuels, solids for transistors, or vaccines. Other chemists, by observing how light is absorbed by a substance or how X-rays or beams of electrons are affected when passed through it, determine the chemical composition of a substance and the atomic makeup of its molecules. Other chemists are interested in bulk properties rather than individual molecules of matter; they examine the behavior of solids, liquids, and reactions on surfaces. Another group of chemists study the rate at which matter undergoes changes in composition, ranging from the combustion in a jet engine to the growth of a living organism. A sizable number of chemists make qualitative and quantitative measurements of the properties of matter and develop analytical instruments and techniques. Biochemists challenge the problems related to the chemistry of life processes. (See separate statement on Biochemists elsewhere in the *Handbook*.)



Chemist checks fire-resistant compound.

Nearly two-fifths of all chemists are engaged in research and development. Many research chemists work on applied research projects to create new products or improve or find new uses for existing ones. Chemists in applied research have helped to develop a vast range of new products including antibiotics, plastics, synthetic rubbers, detergents, insecticides, and manmade fibers. Many other chemists work on basic research to extend scientific knowledge rather than to solve immediate practical problems. Results of basic research frequently apply immediately to practical problems. For example, basic research on polymerization—how and why small molecules unite to form giant molecules—resulted in the development of synthetic rubber, nylon, and plastics.

More than one-fourth of all chemists are employed in management and administration—especially research and development activities. Approximately one-tenth of all chemists devote most of their time to teaching, often combining it with research. Analysis and testing is another major activity of chemists because various kinds of tests must be made at practically every stage in the manufacture of a product, from initial development to final production. Nearly one-fifth of all chemists are engaged in production and inspection activities which may insure, for instance, the quality of final products or the improvement of products and processes. Others work as marketing experts or sales representatives of chemical companies and other manufacturers in positions where the employee must be familiar with the technical aspects of products. Some chemists work as private consultants to private industry firms and government agencies.

Places of Employment

Chemistry is by far the largest field of employment in the physical sciences. Nearly 137,000 chemists were employed in the United States in 1970; about seven percent were women.

Approximately three-fourths of all chemists were employed by private industry in 1970. The chemicals manufacturing industry employed almost half of these chemists. Relatively large numbers of other chemists were found in the industries manufacturing food, scientific instruments, petroleum, rubber, paper, textiles and apparel, electrical equipment, and primary metals products. Independent laboratories and research institutes providing consulting services and distributors of chemical, pharmaceutical, food, and petroleum products also employed significant numbers of chemists.

Colleges and universities employed more than 25,000 chemists. A smaller number worked for nonprofit research organizations. A number of chemists were employed by Federal Government agencies, chiefly the U.S Departments of Defense; Health, Education, and Welfare; Agriculture; and Interior. Small numbers worked for State and local governments, primarily in agencies concerned with health or agriculture.

Chemists were employed in all States, in small as well as large cities. However, they were usually concentrated in large industrial areas. Nearly one-fifth of all chemists were located in four metropolitan areas—New York, Chicago, Philadelphia, and Newark. About half of the total worked in six States —New York, New Jersey, California, Pennsylvania, Ohio, and Illinois.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in chemistry is usually the minimum educational requirement for starting a career as a chemist. Graduate training is essential for many positions, particularly in research and college teaching, and is helpful for advancement in all types of work.

Training leading to the bachelor's degree in chemistry is offered by about 1,000 colleges and universities throughout the country. In addition to the required chemistry courses in analytical, inorganic, organic, and physical chemistry, the undergraduate chemistry major also takes courses in mathematics (especially analytical geometry and calculus) and physics.

Advanced degrees in chemistry are awarded by 300 colleges and universities, many of which offer financial assistance to students interested in graduate study. In graduate school, the student usually specializes by taking several courses in a particular field of chemistry. Requirements for the master's or doctor's degree vary by institution, but usually include a thesis based on independent research.

New graduates having the bachelor's degree usually qualify for beginning positions in analysis and testing, quality control, technical service and sales, or assist senior chemists in research and development work. Most chemists having only the bachelor's degree start their careers in industry or government. In industry, employers often have special training programs for new chemistry graduates. These programs supplement college training with specific industry techniques and help determine the type of work for which the new employee is best suited. Some chemists who have the bachelor's degree teach or do research in colleges and universities while working toward advanced degrees. They also may qualify as secondary school teachers.

Chemists having the master's degree often qualify for applied research positions in government or private industry. They also may qualify for some teaching positions in colleges and universities and in 2-year colleges.

The Ph. D. degree generally is required for basic research, for higher level faculty positions in a college or university, or for advancement to top-level positions in administration and in other activities.

Students planning careers as chemists should enjoy studying science and mathematics, and working with their hands to build scientific apparatus and perform experiments. Perseverance and the ability to concentrate on detail and work independently are essential to the prospective chemist. Other desirable assets include an inquisitive mind, good memory, and imagination. The ability to write is important in preparing reports on experiments. Chemists also should have good eye-hand coordination and eyesight.

Employment Outlook

The employment outlook for chemists is expected to be favorable through the 1970's. In addition to new opportunities resulting from the rapid growth expected in the profession, thousands of new chemists will be needed each year to replace those who retire, die, or transfer to other occupations.

Chemists will continue to be needed to perform research and development work. Through the 1970's, research and development (R&D) expenditures of Government and industry are expected to increase, although at a slower rate than during the 1960's. The anticipated slowdown in Federal R&D spending basically reflects anticipated reductions in the relative importance of the space and defense components of R&D expenditures. These trends were evidenced in the late 1960's and in 1970.

R&D expenditures not only create jobs for chemists in research and development, but also produce new products that result in new positions for chemists in other types of work.

Another factor increasing the opportunities for chemists is the growing demand for industrial products. These include plastics, manmade fibers, drugs, fertilizers, and high energy and nuclear fuels for missiles and space ships.

Chemists also will be required to teach at colleges and universities through the 1970's to accommodate larger enrollments expected at these institutions. The greatest demand in colleges and universities will be for those who have Ph. D. degrees, but many openings, especially in 2-year colleges, also should arise for chemists who have master's degrees. (See statement on College and University Teachers.)

New graduates also will find openings in high school teaching, provided they have completed the professional education courses and other requirements for a State teaching certificate. However, they usually are regarded as teachers rather than as chemists. (See statement on Secondary School Teachers.)

Earnings and Working Conditions

Inexperienced chemistry graduates having a bachelor's degree had an average (median) starting salary of about $9,400 a year in private industry in 1970, according to a survey conducted by the American Chemical Society. Inexperienced graduates having the master's degree averaged about $11,000 a year and those having the Ph. D. degree, about $15,000.

In academic institutions, the average (median) annual starting salary for the few entrants having the bachelor's degree and no experience was about $6,600, according to the American Chemical Society. The average salary for inexperienced graduates having the master's degree was about $8,000, and for those having the Ph. D degree, $11,200. Many experienced chemists in educational institutions supplement their regular salaries with income from consulting, lecturing, and writing. Depending on the individual's college records, the annual starting salary in the Federal Government in 1970 for an inexperienced chemist having the bachelor's degree was either $8,292 or $10,258. Beginning chemists who have 1 year of graduate study could start at $10,258 and those who have 2 years of graduate study at $11,526. Chemists having the Ph. D. degree could start at $13,096 or $14,192.

The average (median) annual salary for all chemists was $15,300 in 1970, according to the National Science Foundation's National Register of Scientific and Technical Personnel. Only 10 percent of all chemists earned less than $9,600 a year, and about 10 percent earned $24,000 or more.

Chemists spend most of their time working in modern, well-equipped, well-lighted laboratories, offices, or classrooms. Chemists work with chemicals that can be dangerous if handled carelessly. However, when safety regulations are followed, health hazards are negligible.

Sources of Additional Information

General information on career opportunities and earnings for chemists may be obtained from:

American Chemical Society, 1155 16th St. NW., Washington, D.C. 20036.

Manufacturing Chemists' Association, Inc., 1825 Connecticut Ave. NW., Washington, D.C. 20009.

Specific information on Federal Government careers may be obtained from:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20415.

For additional sources of information, see statements on Biochemists, Chemical Engineers, and Industrial Chemical Industry. Information on chemical technicians may be found in the statement on Technician Occupations.

PHYSICISTS

(D.O.T. 023.081 and .088)

Nature of the Work

The flight of astronauts through space, the probing of the oceans' depths, or even the safety of the family car depend on research by physicists. By determining basic laws governing phenomena such as gravity, electromagnetism, heat flow, and radioactivity, potential difficulties can be anticipated and overcome.

Physicists observe and analyze various forms of energy, the structure of matter, and the relationship between matter and energy. From their research, physicists develop theories and discover fundamental laws that describe the behavior of the forces at work within the universe. Their studies have continued to broaden man's understanding of the physical world and have enabled him to make increasing use of natural resources. Physicists have contributed to scientific progress in recent years in areas such as nuclear energy, electronics, communications, and aerospace.

Physicist examines hydrogen detection material.

Nearly three-fifths of all physicists are engaged in research and development. Some conduct basic research to increase scientific knowledge with only secondary regard to its practical applications. Some of these, called theoretical physicists, attempt to describe in mathematical terms interactions between matter and energy. Others, called experimental physicists, make careful systematic observations and perform experiments to identify and quantify these interactions. For example, they try to identify and measure the lifetime of tiny particles of matter which may exist within the nucleus of the atom. Experimental physicists use apparatus such as particle accelerators, X-ray spectrometers, microwave devices, lasers, and phase and electron microscopes. They may design new kinds of instruments. The difference between theoretical and experimental physicists is often merely one of emphasis. Some members of the profession are skilled in both types of work.

A large number of physicists who are engineering-oriented engage in applied research and development. They use the knowledge gained from basic research to solve practical problems or to develop new or improved products. For example, the work of physicists specializing in solid-state physics led to the development of transistors and microcircuits, which have replaced vacuum tubes in many types of electronic equipment ranging from hearing aids to guidance systems for missiles.

About one-fifth of all physicists teach in colleges and universities. Approximately another fifth are engaged in management and administration, especially research and development programs. A small number work in activities related to the production of industrial products such as inspection and quality control. Some physicists do consulting work.

Most physicists specialize in one or more branches of the science—mechanics, thermal phenomena, high energy physics, optics, acoustics, electromagnetism, electronics, atomic and molecular physics, nuclear physics, physics of fluids, solid-state physics, or classical theoretical physics. They may concentrate in a subdivision of one of these branches. For example, within solid-state physics they may specialize in ceramics, crystallography, or semiconductors, among others. In addition, emerging knowledge continually opens new areas of research. For example, the development of lasers and masers has led to new experimentation in optics and other fields. However, since all physics specialties rest on the same fundamental principles, the physicist's work often overlaps a number of specialties.

Physicists often apply the theories and methodology of their science to problems originating in other sciences, including astronomy, biology, chemistry, and geology. Growing numbers of scientists specialize in fields that combine physics and a related science. Thus, a number of specialties have developed on the borderline between physics and other fields—astrophysics, biophysics, chemical physics, and geophysics. (Information on these occupations is continued elsewhere in the *Handbook*.) Furthermore, the practical applications of physicists' work have increasingly merged with engineering.

Places of Employment

Approximately 48,000 physicists were employed in the United States in 1970; nearly 4 percent were women. Private industry employed more than 18,000; two-fifths of whom worked in the electrical equipment, ordnance, and chemicals industries. Commercial laboratories and independent research institutes employed more than one-fourth of the physicists in private industry.

In 1970, colleges and universities employed almost 22,000 research or teaching physicists, many of whom combined both activities. Federal government agencies employed approximately 6,600 physicists in 1970, more than three-fourths of whom worked for the Department of Defense. The National Bureau of Standards and the National Aeronautics and Space Administration also employed significant numbers of physicists. Nonprofit organizations employed more than 1,500 physicists.

Physicists were employed in all States. However, their employment was greatest in those areas having industrial concentrations and large colleges and universities. Nearly one-fourth of all physicists were employed in four metropolitan areas—Washington, D.C., Boston, New York, and Los Angeles-Long Beach. More than one-third of the total were employed in three States—California, New York, and Massachusetts.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in physics is generally the minimum entrance requirement for young people seeking careers as physicists. Graduate training is required for many entry positions and is helpful for advancement in all areas of work.

A doctor's degree usually is required for full faculty status at colleges and universities. Also, the doctorate generally is needed for employment in positions involving responsibility for research and development with any type of employer.

Physicists having master's degrees qualify for many research jobs in private industry, educational institutions, and government. Some also instruct in colleges and universities. Usually, graduate students working toward a doctor's degree are assigned to teach elementary college courses, conduct laboratory sessions, or assist senior faculty members on research projects.

Physicists having bachelor's degrees qualify for a variety of jobs in applied research and development work in private industry or the Federal government. Some become research assistants in colleges and universities while working toward advanced degrees. Many persons having a bachelor's degree in the sciences do not work as physicists but enter nontechnical work, other sciences, or engineering.

Over 800 colleges and universities offer training leading to the bachelor's degree in physics. In addition, many engineering schools offered a physics major as part of the general curriculum. The undergraduate program in physics provides a broad background in the science, which serves as a base for later specialization either in graduate school or on the job. A few of the physics courses typically offered in an undergraduate program are mechanics, electricity and magnetism, optics, thermodynamics, and atomic and molecular physics. In addition, courses in chemistry and mathematics are required.

Approximately 250 colleges and universities offer advanced degrees in physics. In graduate school, the student, with faculty guidance, usually works in a specific field. The graduate student, especially the candidate for the Ph. D. degree, spends a large portion of his time in research.

Students planning a career in physics should have an inquisitive mind, good memory, and imagination. Perseverance and the ability to concentrate on detail also are important. The occupation requires constant study and the ability to work independently. Prospective physicists should also possess good eye-hand coordination and eyesight.

Employment Outlook

Employment opportunities for physicists are expected to be favorable through the 1970's. In addition to opportunities resulting from the rapid growth expected in this field, other physicists will be needed each year to replace those who transfer to other fields of work, retire, or die.

Graduate training is increasingly the hallmark of full professional status in physics. As in recent years, a demand is expected for physicists who have advanced degrees to teach in colleges and universities. Among the factors contributing to the demand for physics teachers are the rapid increase in graduate enrollments and the growing need for physics training in other science and engineering programs.

Physicists also will be required in substantial numbers to do complex research and development work related to physics, engineering, or other natural sciences. Through the 1970's, research and development (R&D) expenditures of Government and industry are expected to increase, although at a slower rate than during the 1960's. The anticipated slowdown in Federal R&D spending basically reflects anticipated reductions in the relative importance of the space and defense components of R&D expenditures. These trends were evidenced in the late 1960's and in 1970.

New graduates also will find opportunities in other occupations that utilize their training. For example, they may become high school teachers, provided they complete the required professional educational courses and obtain a State teaching certificate. However, they are usually regarded as teachers rather than as physicists. (See statement on Secondary School Teachers elsewhere in the *Handbook.*)

Earnings and Working Conditions

Starting salaries for physicists having bachelor's degrees were usually about $9,900 a year in private industry in 1970, according to the limited information available. Physicists having master's degrees received starting salaries about $1,900 higher than those having bachelor's degrees. Depending on specialty and experience, graduates having Ph. D. degrees generally received entrance salaries of around $15,000 annually, although some were paid considerably less.

Depending on their college records, physicists having bachelor degrees and no experience could start work in the Federal Government in 1970 at either $8,292 or $10,258. Beginning physicists who had completed all the requirements for the master's degree could start at $10,258 or $11,526. Physicists having the Ph. D degree could begin at $13,096 or $14,192.

Starting salaries for physicists having the Ph. D. degree on college and university faculties averaged $1,000 per month in 1970. (For further information, see statement on College and University Teachers.) Many faculty physicists supplement their regular incomes and satisfy their professional interests through consulting work and special research projects.

The average (median) annual salary for physicists was $15,900 in 1970, according to the National Science Foundation's Register of Scientific and Technical Personnel. Only 10 percent earned less than $10,000 a year, and about 10 percent earned $25,000 or more.

Sources of Additional Information

General information on career opportunities in physics may be obtained from:

American Institute of Physics, 335 East 45th St., New York, N.Y. 10017.

Information on Federal Government careers may be obtained from:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20415.

ASTRONOMERS

(D.O.T. 021.088)

Nature of the Work

Astronomy often is considered the most theoretical of all sciences, although it has many practical applications. Astronomers study the structure, extent, and evolution of the universe. They collect and analyze data on the sun, moons, planets, and stars, and attempt to determine the sizes, shapes, surface temperatures, chemical composition, and motions of these bodies and make studies of the gases and dust between them. They compute the positions of the planets; calculate the orbits of comets, asteroids, and artificial satellites; make statistical studies of stars and galaxies and study the origin and nature of cosmic radiation. Astronomers also study the size and shape of the earth and the properties of its upper atmosphere. Astronomical observations are valuable to navigation and the accurate measurement of time.

In making detailed observations of the heavens, astronomers use complex photographic techniques, light-measuring instruments, and other optical devices. Astronomers actually spend a limited amount of time at the telescope, the major instrument used for observation. Devices for making specialized observations are usually attached to the telescope. Other methods of observation include the use of rockets, balloons, and satellites carrying various measuring devices. In processing and analyzing the vast amounts of data derived from their observations, astronomers often use electronic computers and spectrophotometers.

Astronomer uses telescope to determine position of stars.

Astronomers usually specialize in one of the many branches of the science. In *astrophysics,* they apply physical laws to stellar atmospheres and interiors. Some astronomers work in the field of dynamical astronomy, one of the oldest fields of astronomy that has recently acquired new importance. This branch deals, in part, with the motions of objects in the solar system, and hence has a particular application in the calculation of the orbits of spacecraft and artificial earth satellites and the paths of ballistic missiles. *Radio astronomy* is a technique used to study the source and nature of celestial radio waves by means of radio telescopes. Among the many other specialties are *astrometry* (measurement of angular positions and movements of celestial bodies); photoelectric and photographic *photometry* (measurement of the intensity of light); *spectroscopy of astronomical sources* (wave length analyses of radiation from celestial bodies); and *statistical astronomy* (statistical study of large numbers of celestial objects, such as stars, to determine their average properties).

More than two-thirds of all astronomers are engaged in research activities. Nearly a fifth are employed in colleges and universities, primarily as teachers. In some schools not having separate departments of astronomy or having only small enrollments in the subject, astronomers may teach courses in mathematics or physics as well as astronomy. Other members of the profession are engaged in a variety of activities, including administration of research programs, development and design of astronomical instruments, and consultation in areas to which astronomy is applied.

Places of Employment

Astronomy is one of the smallest of the physical sciences; in 1970, the total number of astronomers in the United States was estimated to be about 1,300. Nearly three-fourths of all astronomers were employed by colleges and universities. Many of these worked in university-operated observatories, where they usually devoted most of their time to research. Other astronomers worked for observatories financed by nonprofit organizations.

The Federal Government employed more than 100 astronomers in 1970. Most of these were employed by the Department of Defense, mainly by the U.S. Naval Observatory and the U.S. Naval Research Laboratory. A couple hundred astronomers were employed in private industry, many by firms in the aerospace field. A few astronomers worked for museums and planetariums.

Training, Other Qualifications, and Advancement

Young people seeking professional careers in astronomy should obtain an advanced degree—preferably the Ph. D. The doctorate usually is required for high-level positions in teaching and research and is important for other types of work in this field. Although the bachelor's degree is adequate preparation for some entry jobs, astronomers without graduate work usually find that opportunities for promotion are limited.

Undergraduate curriculums leading to the bachelor's degree in astronomy are offered by only about 40 colleges and universities. The undergraduate work of the prospective astronomer is weighted heavily with courses in physics and mathematics. Courses in chemistry, statistics, and electronics also are useful. A few of the courses often taken by astronomy undergraduates are mechanics, electricity and magnetism, introductory courses in astronomy and astrophysics, and astronomical techniques and instruments.

The prospective astronomer is not necessarily handicapped if the college he has selected for his undergraduate study does not offer a major in astronomy. Well-qualified students having a bachelor's degree in physics or mathematics with a physics minor usually are able to enter and pursue graduate programs in astronomy without difficulty.

Programs leading to the doctorate in astronomy are available at about 30 institutions located in various sections of the country. The graduate student takes advanced courses primarily in astronomy, physics, and mathematics. A few graduate schools offer celestial mechanics, galactic structure, radio astronomy, stellar atmospheres and interiors, theoretical astrophysics, and binary and variable stars. Some schools require that graduate students spend several months in residence at an observatory. In most institutions, the program of work leading to the doctorate is flexible and allows the student to take the courses which will be of most value in his particular area of interest.

New graduates having a bachelor's or master's degree in astronomy usually begin as assistants in observatories, planetariums, large departments of astronomy in colleges and universities, Government agencies, or industry. Some persons having only the bachelor's degree work as research assistants while studying toward advanced degrees; others, particularly those in Government employment, receive on-the-job training in the application of astronomical principles. New graduates having the doctorate can usually qualify for college teaching positions and for research positions in educational institutions, Government, and industry.

Young persons planning a career in astronomy should have inquisitive minds, imagination, and they should like working with ideas. Perseverance, the ability to concentrate on detail and to work independently also are important.

Employment Outlook

Employment opportunities for astronomers having the Ph. D. degree are expected to be favorable through the 1970's. Well-qualified persons with only bachelor's or master's degrees in astronomy will have favorable employment prospects, primarily as research and technical assistants. As in the past, however, the higher level professional positions in astronomy will be filled mainly by persons having the doctorate.

The outlook is for a rapid growth of this small profession through the 1970's. However, because astronomy is a small profession, the number of job openings in any 1 year will not be large. On the other hand, because relatively few college students are expected to receive advanced degrees in astronomy each year, those who do should have good employment opportunities.

Among the factors underlying the expected increase in demand for astronomers is the progress of the space age—the age of rockets, missiles, manmade earth satellites, and space exploration. Astronomers will be needed to analyze the data collected by rockets and spacecraft. They also will be needed to plan and give direction to the astronomical observations that can only be carried out by means of equipment placed in space vehicles.

Increased research activities in astronomy by educational institutions, Government, and industry are expected to add to the demand for astronomers. In recent years, the growth of Federal Government-sponsored research, in the form of grants to educational institutions and observatories (for astronomical research and for new buildings, observatories, and equipment), has opened many new positions for astronomers.

Earnings and Working Conditions

In 1970, beginning astronomers having the Ph. D. were eligible to enter Federal Government service at a salary of $13,096 or $14,192 a year, depending on their college record. Astronomers having the bachelor's degree could start at $8,292 or $10,258 a year; those having a bachelor's degree and some graduate study could begin at $10,258 or $11,526.

According to the National Science Foundation's National Register of Scientific and Technical Personnel, the average (median) annual salary of all astronomers having the Ph. D. degree was $15,100 in 1970. Those with master's degrees averaged $13,100 and bachelor's degree holders also averaged $13,100 in 1970.

Some astronomers make visual

photographic or photoelectric observations at night. Others make observations only 4 or 5 nights each month, or even only a few nights a year, and study and analyze photographic plates, photoelectric tracings, and other material during usual daytime working hours. Observational work at a telescope involves exposure to the outside air through the open dome of the observatory, sometimes on cold winter nights. In general, however, the physical requirements of astronomical work can be met by a reasonably healthy person.

Sources of Additional Information

General information on careers in astronomy may be obtained from:

American Astronomical Society, 211 FitzRandolph Rd., Princeton, N.J. 08540.

Specific information on Federal Government career opportunities may be obtained from:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20415.

FOOD SCIENTISTS

(D.O.T. 022.081, 040.081, 041.081)

Nature of the Work

Someone has estimated that the average family of four consumes over 5,000 pounds of food a year. In the past, most food processing was done at home but today, almost all food is processed by industry. Although people in many different occupations are employed in food processing, this statement is concerned with only the food scientist or *food technologist.*

Food scientists investigate the fundamental chemical, physical, and biological nature of food and apply this knowledge to processing, preserving, and storing an adequate, nutritious, and wholesome food supply. About two-fifths of all scientists in food processing are employed in basic or applied research, and development. Others work in a quality assurance laboratory, or in the production or processing area of a food plant. Some teach or do basic research in colleges and universities.

Food scientists in basic research study the structure and composition of foods and their changes in processing or storage. For example, they may be interested in developing new sources of proteins, studying the effects of food processing on microorganisms, or searching for factors that affect the flavor, texture, or appearance of foods.

In applied research and development, food scientists create new

Food scientist adds flavor to enhance product.

foods and develop processes for new products. They also improve existing foods by making them more nutritious and enhancing their flavor, color, or texture. They may formulate an idea for a new product or modify an existing item. The idea is submitted to management and, if accepted, a new research project is begun.

The scientist must ensure that each new product will retain its characteristics and nutritive value during storage. He also may conduct chemical and microbiological tests to see that products meet both industry and government standards. Other food scientists test additives for purity, investigate changes that take place during processing or storage, or develop mass-feeding methods for food service institutions. Food scientists also maintain records of their work and prepare reports showing results of tests or experiments.

Food scientists in quality control laboratories check raw ingredients to note freshness, maturity, or suitability for processing. For example, the product may be tested for tenderness by using machines that gauge the amount of force necessary to shear or puncture the item. Periodically, they inspect processing-line operations and perform chemical and bacteriological tests during and after processing to insure conformity with established industry and government standards. These tests vary according to the product and processing method. Canned goods, for example, may be tested for sugar, starch, protein, fat, and mineral content. In a frozen food plant, the scientist must determine that various enzymes are inactive after the product has been processed so that the food does not lose its flavor during storage. Other scientists are concerned with packaging materials that maintain shelf life and product stability.

Whether in research or quality control, food scientists must be familiar with fundamental research techniques and standard testing equipment, such as vacuum gauges and reflectance meters.

Food scientists in quality control laboratories often supervise technicians who assist in product testing. (See statements on Food Processing Technicians.)

Food scientists engaged in production and processing schedule processing operations, prepare production specifications, maintain proper temperature and humidity in storage areas, and supervise sanitation, including the efficient and economical disposal of wastes. Food scientists are responsible for ways to increase processing efficiency. For example, they may advise management on the purchase of equipment and recommend new sources of materials.

Places of Employment

Approximately 7,300 food scientists were employed in the food processing industry in 1970. Less than 10 percent were women. Food scientists are employed in all sectors of the food industry and in every State, particularly California, Illinois, New York, Pennsylvania, Texas, Ohio, New Jersey, Wisconsin, Michigan, and Iowa.

Some food scientists are employed in research by Federal Government agencies such as the Food and Drug Administration, and the Departments of Agriculture and Defense. A few are employed by private consulting firms and international organizations. Some teach or do research in colleges and universities. (See statement on College and University Teachers.)

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in food science or one of the physical or life sciences such as chemistry and biology is the usual minimum educational requirement for a beginning food scientist. Graduate training is essential for many positions, particularly research and college teaching, and for many management level jobs in industry.

Nearly 40 colleges and universities throughout the U.S. offer training leading to the bachelor's degree in food science. Undergraduate courses generally include food chemistry, analysis, microbiology, engineering, and processing. Undergraduate courses include other physical sciences such as physics and mathematics, the social sciences and humanities, and business administration.

Advanced degrees are offered by most of those colleges and universities that provide undergraduate food science programs. In graduate school, students usually specialize in a particular area of food science. Requirements for the master's or doctor's degree vary by institution, but usually include laboratory work and a thesis.

A food scientist with a bachelor's degree might start work in production as a quality assurance chemist or an assistant production manager. After obtaining sufficient experience, the food scientist in production could advance to more responsible management positions. The scientist also might begin as a junior food chemist in the applied research and development laboratory of a food company and be promoted to section head or other research management positions.

Graduates who have a master's degree might begin as senior food chemists in research and development. Graduates who have the Ph. D. probably would begin their careers doing basic research.

Young persons planning careers as food scientists should like technical work and have analytical minds oriented toward detail. Flexibility and innovativeness are important in meeting food needs for an expanding population.

Employment Outlook

Employment opportunities for graduates of food science programs at all degree levels are expected to be favorable through the 1970's. In addition to the scientists needed to fill new positions, several hundred will be needed each year to replace those who retire or die. Among the factors underlying the anticipated increase in requirements for food scientists is an expanding population that is demanding a greater variety of quality convenience foods. Food-service institutions that supply outlets, such as airlines and restaurants, also require many types of convenience foods. An increasing number of scientists also will be required in research and product development. Expenditures for research and development in the food industry have shown moderate increases in recent years and probably will continue to rise. Research could produce new foods from modifications of wheat, corn, rice, and soybeans. For example, some of the "meat" in the future will be manufactured to resemble beef, pork, and chicken. Additional food scientists will be needed in production and quality control because of the complexity of products and processes and the application of higher processing standards.

Earnings and Working Conditions

Inexperienced food science graduates (and graduates of other scientific disciplines) with a bachelor's degree had starting salaries of about $760 per month in 1970, based on limited data. Inexperienced graduates having the master's degree averaged about $940 per month, and those having the Ph. D. degree, about $1,200 per month.

The average (median) salary for all food scientists was $16,000 in 1970, according to the National Science Foundation's National Register of Scientific and Technical Personnel.

Most food scientists work in modern, well-lighted and ventilated laboratories. However, food scientists may face a slight hazard from slippery floors in pilot or processing plants.

Sources of Additional Information

Information on a variety of careers in food science, and a list of schools offering programs in food science may be obtained from:

The Institute of Food Technologists,
Suite 2120, 221 North LaSalle
Street, Chicago, Illinois 60601.

PERFORMING ARTISTS AND OTHER ART RELATED OCCUPATIONS

The performing arts include music, acting, singing, and the dance. In these fields, the number of talented persons seeking employment generally greatly exceeds the number of full-time positions available. As a result, many performers supplement their incomes by teaching, and others work much of the time in different types of occupations.

The difficulty of earning a living as a performer is one of the facts young persons should bear in mind in considering an artistic career. They should consider, therefore, the possible advantages of making their art a hobby rather than a profession. Aspiring young artists usually must spend many years in intensive training and practice before they are ready for public performances. They need not only great natural talent but also determination, a willingness to work long and hard, and an overwhelming interest in their chosen field.

The statements which follow this introduction give detailed information on musicians, singers, actors, and dancers.

ACTORS AND ACTRESSES

(D.O.T. 150.028 and 150.048)

Nature of the Work

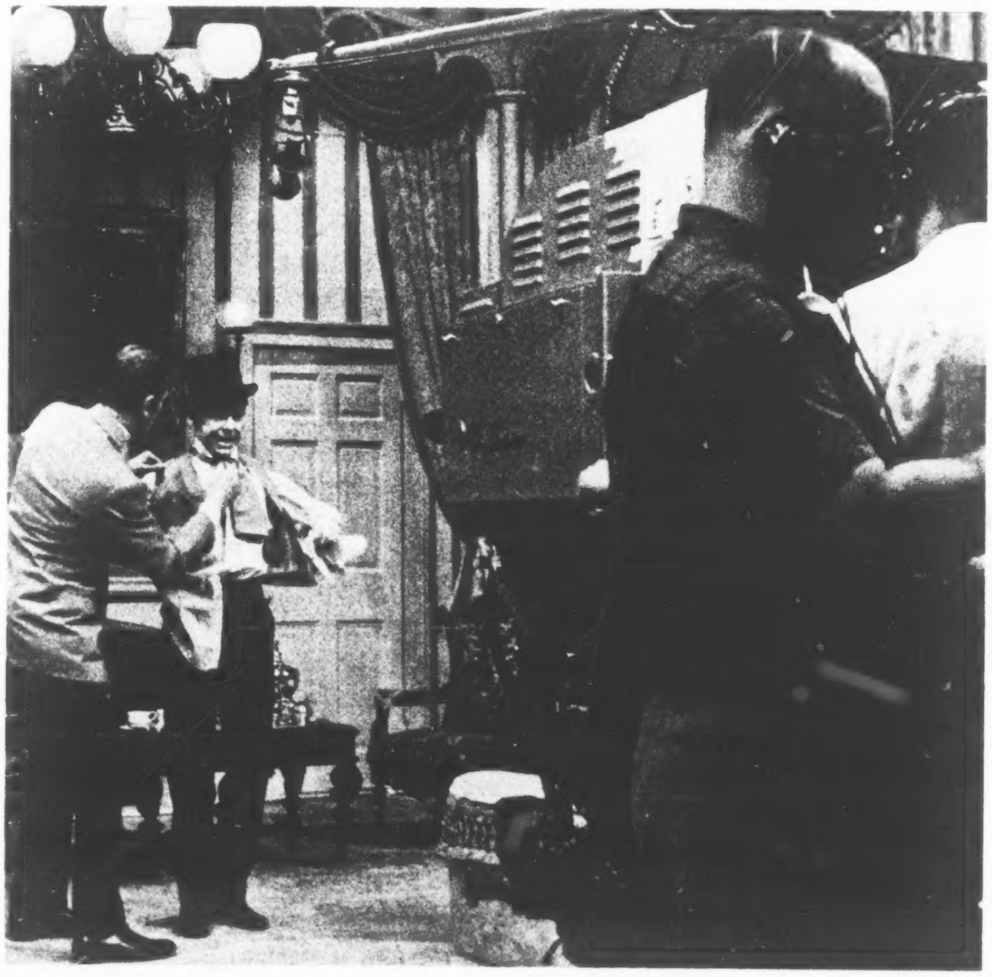
Making a character come to life before an audience is a job that has great glamour and fascination. It is also hard and demanding work that requires special talent and involves many difficulties and uncertainties.

Only a few of the approximately 15,000 actors and actresses in the United States in 1970 have achieved recognition as stars—on the stage, in motion pictures, or on television or radio. A somewhat larger number are well-known, experienced performers, who frequently are cast in supporting roles. However, most of these workers are struggling for a toehold in the profession, and are glad to pick up parts wherever they can.

New actors generally start in "bit" parts, where they speak only a few lines. If successful, they may progress to larger, supporting roles, of which there are several in most stage, television, and screen productions. Actors who have minor parts in stage productions also may serve as understudies for the principals. If a leading player misses a performance, the understudy has a chance to demonstrate his acting ability.

Actors who prepare for roles either on the stage, in television, or in the movies spend many hours in rehearsal. They must memorize their lines and know their cues. Radio actors typically read their parts. They have to be especially skilled in expressing character and emotion through the voice, since this is their sole means of creating an impersonation for their audience.

In addition to the actors with speaking parts, "extras," who have no lines to deliver, are used in almost every motion picture and many television shows and theatre



productions. In spectacular productions, a large number of extras take part in crowd scenes.

Some actors find alternative jobs as dramatic coaches or become directors of stage, television, radio, or motion picture productions. A few teach in schools of acting or in the drama departments of colleges and universities.

Places of Employment

Stage plays, motion pictures (including films made especially for television), and commercials are the largest fields of employment for actors, although some are employed by "live" television and radio.

In the winter, most employment opportunities on the stage are in New York and other large cities. In the summer months, stock companies in suburban and resort areas throughout the Nation provide many opportunities for employment. In addition many cities now have "little theaters," repertory companies and dinner theaters, which provide opportunities for local talent as well as for professional actors and actresses from New York and other centers. Plays that go "on the road," moving from city to city, are normally produced in New York City with casts selected there.

Although employment opportunities in motion pictures and film television are centered in Hollywood, a few studios are in New York City; Miami, Fla.; and other parts of the country. In addition, many films are shot on location, providing employment for nonprofessionals who live in the area as "extras." An increasing number of American-produced films are being shot in foreign countries. In live television and radio, most opportunities for actors are at the headquarters of the major networks—in New York, Los Angeles, and, to a lesser extent, Chicago. A few local television and radio stations occasionally employ actors.

Training and Other Qualifications

Young people aspiring to acting careers should get as much acting experience as possible by taking part in high school and college plays, or working with little theaters and other acting groups in their home towns.

Formal training in acting is increasingly necessary. Such training can be obtained at special schools of the dramatic arts, located chiefly in New York, and in over 500 colleges and universities throughout the country. College drama curriculums usually include courses in liberal arts, speech, pantomime, play production, and the history of the drama, as well as practical courses in acting. From these, the student develops an appreciation of the great plays and a greater understanding of the roles he may be called on to play. Graduate degrees in the fine arts or in drama are necessary for college teaching positions.

Acting demands patience and total commitment since aspiring actors and actresses must wait for parts or filming schedules, must work long hours, and often must do much traveling. Flawless performances require long rehearsal schedules and the tedious memorizing of lines. The actor needs stamina to withstand the heat of stage or studio lights, or the adverse weather conditions which may exist "on location." Above all, young persons planning a career in acting must have talent and the creative ability to portray different characters. They must have poise, stage presence, and aggressiveness to project themselves to the audience. At the same time, the ability to follow directions is important.

In all media, the best way to start is to use local opportunities and to build on the basis of such experience. Many actors who are successful in local dramatic productions eventually try to appear on the New York stage. Inexperienced actors usually find it extremely difficult to obtain employment in New York or Hollywood. The motion picture field is especially difficult to enter, and employment often results from previous experience on Broadway.

To become a movie extra, one must usually be listed by Central Casting, a no-fee agency which works with the Screen Extras Guild and supplies all extras to the major movie studios in Hollywood. Applicants are accepted only when the number of people of a particular type on the list—for example, athletic young men, old ladies, or small children—is below the foreseeable need. In recent years, only a very small proportion of the total number of applicants has succeeded in being listed. Extras have very little, if any, opportunity to advance to speaking roles in the movies.

The length of an actor's working life depends largely on his skill and versatility. Great actors and actresses can work almost indefinitely. On the other hand, employment opportunities become increasingly limited by middle age, especially for those who become typed in romantic, youthful roles.

Employment Outlook

Overcrowding has existed in the acting field for many years and it is expected to persist. In the legitimate theater and also in motion pictures, radio, and television, numbers of job applicants greatly exceed the jobs available. Moreover, many actors are employed in their profession for only a small part of the year.

The development of motion pictures, radio, and TV has greatly reduced employment opportunities for actors in the theater. Although a motion picture production may use a very large number of actors, they are employed only during filming and the films are widely distributed and may be used for years. Also, the increasing number of American-produced films being shot in foreign countries will reduce employment opportunities for American actors. Radio uses few actors. The number of filmed TV dramas and commercials using actors is increasing, but not enough to offset the decline in other media. Moreover, television stations often broadcast "taped" dramas rather than live productions, and, like motion picture films, these tapes may be widely distributed and used many times.

One possibility for future growth in the legitimate theater lies in the establishment of year-round professional acting companies in more cities. The number of communities with such acting groups is growing. The recent growth of summer stock companies, repertory companies, and dinner theaters also has increased employment. Further increases also are likely in the employment of actors on television due partly to the expanding Public Broadcasting System and UHF stations. In addition, increased employment opportunities are expected as a result of the expanded use of cable TV (pay TV). Also, the development and wider use in the future of video cassettes will result in more employment opportunities.

In the acting field as a whole, however, employment opportunities are expected to change little through the 1970's. The number of new entrants to the profession is expected to outnumber employment opportunities. Even highly talented young people are likely to face stiff competition and economic difficulties in the profession.

Earnings and Working Conditions

Actors and actresses employed in the legitimate theater belong to the Actors' Equity Association. If employed in motion pictures, including television films, they belong to the Screen Actors Guild, Inc., or to the Screen Extras Guild, Inc. If employed in television or radio, they belong to the American Federation of Television and Radio Artists. These unions and the show producers sign basic collective bargaining agreements which set minimum salaries, hours of work, and other conditions of employment. In addition, each actor enters into a separate contract which may provide for higher salaries than those specified in the basic agreement.

The minimum weekly salary for actors in Broadway productions was about $165 in 1970. Those appearing in small "off-Broadway" theaters received a minimum of $75 a week. For shows on the road, the minimum rate was about $220 a week. Earnings for rehearsal time were about $165 a week in Broadway shows and much lower in small "off-Broadway" theaters. (All minimum salaries are automatically, by union contract, adjusted upward commensurate with increases in the cost of living as reflected in the Bureau of Labor Statistics Consumer Price Index.)

Motion picture actors and actresses had a minimum daily rate of $120 in 1970. For extras, the minimum rate was about $33 a day. Actors on network television received a minimum program fee of about $180 for a single half-hour program and 10 hours of rehearsal time; actors on radio received about $50 for a half-hour performance, including one rehearsal hour. To encourage more stable employment on radio and TV, minimum guarantees for those actors with contracts for a series of programs are sometimes discounted below the single program guaranteed fee. Because of the frequent periods of unemployment characteristic of this profession, annual earnings may be low for many of the lesser known performers. In all fields, many well-known actors and actresses have salary rates above the minimums. Salaries of the few top stars are many times the figures cited.

Eight performances amount to a week's work on the legitimate stage, and any additional performances are paid for as overtime. The basic workweek after the opening of a show is 36 hours, including 12 hours for rehearsals. Before the opening, however, the workweek usually is longer to allow enough time for rehearsals. Evening work is, of course, a regular part of a stage actor's life. Rehearsals may be held late at night and on weekends and holidays. When plays are on the road, traveling over the weekend often is necessary.

Most actors are covered by a pension fund and a growing number have hospitalization insurance to which their employers contribute. All equity members have paid vacations and sick leave. Most stage actors get little if any unemployment compensation solely from acting, since they seldom have enough employment in any State to meet the eligibility requirements. Consequently, when a show closes, they often have to take any casual work obtainable while waiting for another role.

DANCERS

(D.O.T. 151.028 and 151.048)

Nature of the Work

Dancing is an ancient and worldwide art, having many different forms. Professional dancers may perform in classical ballet or modern dance, in dance adaptations for musical shows, in folk dances, or in tap and other popular kinds of dancing. In the classical ballet, movements are based on certain conventional or styled "positions," and women dance "en pointe" (on the tips of their toes). In the modern dance, movements are much more varied but are nonetheless carefully planned and executed to follow a pattern.

In dance productions, the performers most often work together as a chorus. However, a group of selected dancers may do special numbers, and a very few top artists do solo work.

Many dancers combine teaching with their stage work or teach full time in schools of the dance or in colleges and universities. The few dancers who become choreographers create new ballets or dance routines. Others are dance directors who train dancers in new productions.

(This statement does not include instructors of ballroom and other social dancing.)

Places of Employment

In 1970, there were approximately 23,000 dancers and dancing teachers in the United States. More than half of this number were teachers employed at schools of the dance and in other schools and colleges. Most of the other dancers were performers on the stage, screen, and television. A few teachers trained in dance therapy were employed by hospitals to work in the treatment of mental disorders. About 90 percent of all dancers are women, but in some types of dance, particularly ballet and modern, women constitute about one-half of the performers.

Dancing teachers are located

chiefly in large cities, but many smaller cities and towns have schools of the dance. New York City is the hub for the majority of performing dancers; others are situated in most large cities.

Training and Other Qualifications

Serious training for a dancing career traditionally begins by age 12 or earlier. For example, girls wishing to become ballet dancers should begin taking lessons at the age of 7 or 8. From 2 to 3 years of prior preparation is needed before the young girl should start dancing "en pointe." Professional training in ballet typically takes from 10 to 12 lessons a week for 11 or 12 months in the year and many additional hours of practice. The length of the training period depends on the student's ability and physical development, but most dancers have their professional audition by age 17 or 18.

The selection of a professional dancing school is important for two reasons. First, the school must use expert judgment in setting the pace of training, since too early and too severe exercise can permanently damage the legs and feet. Second, the school's connections with producers may help the students in obtaining employment.

Because of the strenuous training program in the professional schools, the general education received by students in these schools may not exceed the legal minimum. However, a dancer's education should include subjects such as music, literature, and history to aid him in his interpretation of dramatic episodes and music.

About 200 colleges and universities confer bachelor's degrees on students who have either majored in physical education and concentrated on the dance, majored in a dance program designed to prepare students to teach dance, or majored in a dance program designed to prepare students as professional dance artists. Some of these schools also give graduate degrees.

A college education is an advantage in obtaining employment as a teacher of professional dancing or choreography. However, dancers who postpone their first audition for openings in classical ballet until graduation may compete at a disadvantage with younger dancers.

A teaching position in professional schools usually requires experience as a performer; in colleges and conservatories graduate degrees are generally required, but experience as a performer often may be substituted. Maturity and a broad educational background are also important for teaching positions.

The dancer's life is one of rigorous practice, perfecting of the art, and self-discipline. Good health and physical stamina are necessary, both to keep in good condition and to follow the rugged travel schedule imposed on many dancers.

Height and body build should not vary much from the average. Good feet and normal arches are also required. Above all, one must have a natural aptitude for dancing, a creative ability to express oneself through dance.

Seldom does a dancer perform unaccompanied. Therefore, young persons considering a dancing career should be able to function as part of a team. They also should be prepared to face the anxiety of unstable working conditions brought on by show closings, audition failures, and the like.

For women dancers, employment in ballet companies is very difficult to obtain after the age of 30, except for outstanding stars. Women past 25 are rarely hired for Broadway shows unless they have already had experience in such productions. Men who are ballet dancers, and men and women who perform in modern dance productions, can usually continue somewhat longer. After the employable age as performers has passed, some dancers teach in colleges or conservatories, or establish their own schools. The few who become choreographers or dance directors can continue working as long as persons would in most other occupations.

Employment Outlook

Opportunities in this field will be limited both by the small number of full-time jobs available and the relatively large supply of applicants seeking full-time work. The supply of trained dancers has exceeded the demand for many years. The irregular employment that has persisted for many years is expected to continue despite a few recent union-management contracts aimed at guaranteeing some dancers full or near-full employment each year. Among the factors affecting demand are the decline in the total number of stage productions because of competition from motion pictures and television. Few stage shows run more than 26 weeks and many "fold" after the first week.

On the other hand, the number of shows being produced is increasing, and there is a growing trend toward using professional dancers at industrial exhibitions, such as auto shows. Also, some new professional dance companies are being developed around the country, and television will offer some additional employment opportunities. Civic and community dance groups are increasing in number, and opportunities for dancers will expand as these develop into professional groups. Nevertheless, employment opportunities for dance performers will remain limited, and most of the openings for dancers in the years ahead will stem from the need to replace those who leave the field.

The employment outlook for dancers who have the personal and educational qualifications for teaching will be much better than for those trained only as performers. The growing interest in the dance as one of the fine arts is contributing to the demand for teachers of dancing. The increase in college enrollments will be another factor which will tend to enlarge teaching opportunities. (See statement on "College and University Teachers.")

Men dancers face less competition for employment than do women dancers, since fewer men than women seek dancing as a career.

Earnings and Working Conditions

Dancers who perform professionally are members of one of the unions affiliated with the Associated Actors and Artists of America (AFL-CIO). Dancers who perform in opera ballets, classical ballet, and the modern dance belong to the American Guild of Musical Artists, Inc.; those who perform on television belong to the American Federation of Television and Radio Artists; and those who appear in musical comedies join Actors' Equity Association. Dancers may also be members of other unions, depending upon the field in which they perform. (See statement on Singers and Singing Teachers.) Minimum salary rates, hours of work, and other conditions of employment are specified in basic agreements signed by the unions and the producers. The separate contract signed by each dancer with the producer of the show may be more favorable than the basic agreement regarding salary, hours of work, and working conditions.

The minimum salary for dancers in ballet and other stage productions was about $155 a week in 1970. The minimum rate for rehearsal time was about $135 a week. Dancers performing on tour receive a small allowance to defray the cost of room and board. The rate of per diem in 1970 was $11. The employer pays the cost of transportation. If a dancer signs a contract for a brief appearance in a performance on television or a few days' work in a movie, the minimum rate is higher, relative to time worked. However, this difference is offset by the brevity of the engagement and the long period likely to be spent waiting for the next one. A few performers, of course, have much higher salaries.

Some dancers qualified to teach in schools of the ballet are able to combine this work with engagements as performers. A much greater number of dancers have to supplement their incomes by other types of work.

Salaries of teachers in the technical schools of the ballet vary with the location and prestige of the school. Dancers employed as teachers in colleges and universities are paid on the same basis as other faculty members. (See statement on "College and University Teachers.")

The normal workweek is 30 hours spent in rehearsals and matinee and evening performances. Extra compensation is paid for hours worked outside the normal workweek. Most stage performances take place, of course, in the evening, and rehearsals may require very long hours, often on weekends and holidays. When shows are on the road, traveling over the weekend is often required.

Dancers are entitled to some paid sick leave and various health and welfare benefits provided by their unions, to which the employers contribute.

Sources of Additional Information

Information on colleges and universities and conservatories of music which give a major in the dance or some courses in the dance, and details on the types of courses and other pertinent information may be obtained from the Dance Directory, compiled by the American Association for Health, Physical Education and Recreation, a division of the National Educational Association, 1201 16th St. NW., Washington, D.C. 20036.

Information on wages and working conditions may be obtained from:

American Guild of Musical Artists,
1841 Broadway, New York, N.Y. 10023.

MUSICIANS AND MUSIC TEACHERS

(D.O.T. 152.028 and 152.048; 090.168; 091.168; and 092.228)

Nature of the Work

Professional musicians—whether they play in a symphony orchestra, dance band, rock group, or "jazz combo"—generally have behind them many years of study and intensive practice. As a rule, musicians specialize in either popular or classicial music; only a few play both types professionally.

Musicians who specialize in popular music usually play the trumpet, trombone, clarinet, saxophone, organ, or one of the "rhythm" instruments—the piano, string bass, drums, or guitar. Dance bands play in nightclubs, restaurants, and at special parties. The best known bands, jazz groups, rock groups, and solo performers sometimes give concerts and perform on television.

Musicians specializing in classical music play in opera and theater orchestras, symphony orchestras, and for other kinds of performances requiring orchestral accompaniments. The instruments played by most of these musicians are the strings, brass, and wood winds. Some form small groups—usually a string quartet or a trio—to give concerts of chamber music.

Many pianists accompany vocal or instrumental soloists or choral groups or provide background music in restaurants or other places. Most organists play in churches, often directing the choir. A few exceptionally brilliant musicians become well-known concert artists. They give their own concerts and appear as soloists with symphony orchestras. Both classical and popular musicians often make recordings, either individually or as members of a group.

A very high proportion of all musicians teach in the Nation's schools and colleges. These teachers may be members of the faculty of music schools or conservatories or of colleges which offer instruction in instrumental and vocal music. Some are music teachers in elementary or secondary schools where they direct vocal and instrumental music programs, teach general classroom music appreciation, and give group instruction on an instrument. Private lessons are given by many teachers employed by school systems, and by performing musicians, either in their own studios or in pupils' homes.

A few musicians work in the field of music therapy in hospitals, and in music libraries.

Places of Employment

About 210,000 musicians and music teachers were employed in 1970. Most professional musicians who perform work in cities, where the Nation's entertainment and recording activities are concentrated such as New York, Chicago, Los Angeles, Nashville, Miami Beach, and New Orleans. Music teachers in elementary and secondary schools, as well as in colleges and universities, are employed all over the country. Moreover, almost every town and city has at least one private music teacher. Dance bands and civic orchestras also are located in many communities, although in the smaller towns, their members usually are part-time musicians with other regular jobs.

In addition to the people primarily employed as musicians or music teachers, thousands of qualified instrumentalists have other full-time jobs and only occasionally work as musicians. Most of these part-time musicians belong to dance bands, which are hired to play at private parties or for special occasions. Others, with a background in classical music, play occasionally in an orchestra, become conductors or composers, or do some part-time teaching.

Training and Other Qualifications

Most people who become professional musicians begin studying an instrument at an early age. To achieve a career as a performer or as a music teacher, young people need intensive training—either through private study with an accomplished musician, in a college or university which has a strong music program, or in a conservatory of music. They need to acquire not only great technical skill but also a thorough knowledge of music, and they must learn how to interpret music. Before a young person can qualify for advanced study in a music conservatory or in a college or university school of music, an audition frequently is necessary. Many teachers in these schools are accomplished artists who will train only promising young musicians.

Over 550 conservatories of music and college and university schools of music offer 4-year programs leading to a bachelor's degree in music education. Students who complete these programs can qualify for the State certificate required for elementary and secondary school positions. Conservatories and collegiate music schools also frequently award the degree of bachelor of music to students who major in instrumental or vocal music. The 4-year program leading to either of these degrees provides not only training as a performer but also a broad background in musical history and theory, together with some liberal arts courses. Advanced degrees usually are required for college teaching positions, but exceptions may be made for especially well-qualified artists.

Musicians who play jazz and other popular music must have an understanding of and feeling for that style of music, but skill and training in classical styles may expand their employment opportunities. As a rule, they take lessons with private teachers when young, and seize every opportunity to play in amateur or professional performances. Some groups of young people form their own small dance bands or rock groups. As they gain experience and become known, the players may have opportunities to audition for other local bands, and, still later, for the better known bands and orchestras.

Young persons considering careers in music should have both musical talent and creative ability. They should also have poise and stage presence for facing large audiences. Since quality of performance requires constant study and practice, self-discipline is vital. Moreover, musicians must have the stamina for considerable travel in meeting concert and nightclub engagements, as well as rugged time schedules, often including long night hours.

Employment Outlook

As a field of employment, music performance has been overcrowded for many years, and it is expected to remain so through the 1970's. Opportunities for concerts and recitals are not numerous enough to provide adequate employment for all the pianists, violinists, and other instrumentalists qualified as concert artists. Competition is usually keen for positions which afford some stability of employment—for example, jobs with major orchestras and teaching positions in conservatories and colleges and universities. Because of the ease with which a musician can enter private music teaching, the number of music teachers has been more than sufficient to give instruction to all the young people seeking lessons, and will probably continue to be. Although many opportunities can be expected for single and short-term engagements, playing popular music in night clubs, theaters, and other places, the supply of qualified musicians seeking such jobs is likely to remain greater than the demand. On the other hand, first-class, experienced accompanists and well-trained, outstanding players of stringed instruments are likely to remain relatively scarce; and public school systems will probably continue to need more fully qualified music teachers and supervisors.

Employment opportunities for performers are expected to increase slightly over the long run. Although the number of civic orchestras in smaller communities has been growing steadily, many of these orchestras provide only part-time employment for musicians who work chiefly as teachers or in other occupations. Moreover, the openings created by the establishment of these orchestras have been more than offset by the decline in opportunities in the theater, radio, motion pictures, and other places; this has resulted, in part, from the greatly increased use of recorded music. Some additional employment opportunities are expected to result from the expanded use of cable TV (pay TV). Also, the development and wider use, in the future, of video cassettes will result in some employment opportunities.

The employment outlook in music education for people who are qualified as teachers as well as musicians is better than for those qualified as performers only. The number of schools with music programs is growing and interest in music as an avocation also is rising. Thus, over the long run, an increase can be expected in the employment of elementary and secondary school music teachers and also in the teaching staffs of college and university music schools and conservatories of music.

Earnings and Working Conditions

The amount received for a performance by either classical or popular musicians depends to a large extent on their professional reputations. Musicians who were members of 1 of the 28 major symphony orchestras in the United States had minimum salaries ranging from about $5,100 to $16,500 a year in 1970 according to the American Symphony Orchestras League, Inc. Six orchestras—New York, Boston, Philadelphia, Cleveland, Cincinnati, and Chicago—have year-round seasons and minimum salaries ranging from $10,900 to $16,500. The remaining 22 orchestras have seasons ranging from 32 to 49 weeks. Instrumentalists who were members of small ensembles reportedly received as much as $200 a concert. Those who played in dance bands were paid from $60 to $300 a week in 1970, according to the limited information available.

The salaries of public school music teachers are determined by the salary schedule adopted for all teachers. (See statements on Elementary and Secondary School Teachers.) However, they frequently supplement their earnings by giving private music lessons and taking church positions. Earnings from private lessons are uncertain and vary according to the musician's reputation, the number of teachers in the locality, the number of students desiring lessons, and the economic status of the community.

Musicians who are performers customarily work at night and on weekends. They must also spend considerable time in regular daily practice and in rehearsal of new scores.

Many musicians, primarily those employed by symphony orchestras, work under master wage agreements, which guarantee them a season's work lasting up to 52 weeks. Musicians in other areas, however, may face relatively long periods of unemployment between jobs and, thus, the overall level of their earnings generally is lower than that of many other occupations. Moreover, they do not usually work steadily for one employer. Consequently, some performers cannot qualify for unemployment compensation, and few have either sick leave or vacations with pay.

Most musicians who play professionally belong to the American Federation of Musicians (AFL-CIO). Concert soloists also belong to the American Guild of Musical Artists, Inc. (AFL-CIO).

Sources of Additional Information

Information about wages, hours of work, and working conditions for professional musicians is available from:

American Federation of Musicians (AFL-CIO), 641 Lexington Ave., New York, N.Y. 10022.

Information about the requirements for certification of organists and choir masters may be secured from:

American Guild of Organists, 630 Fifth Ave., New York, N.Y. 10020.

A list of accredited schools of music is available from:

National Association of Schools of Music, One Dupont Circle, NW., Washington, D.C. 20036.

Further information about music teaching in elementary and secondary schools is available from:

Music Educators National Conference, The National Education Association, 1201 16th St. NW., Washington, D.C. 20036.

SINGERS AND SINGING TEACHERS

(D.O.T. 152.048 and .028; 090.168; 091.168; and 092.228)

Nature of the Work

Professional singing is an art that usually requires not only a fine voice but also a highly developed technique and a broad knowledge of music. A small number of singing stars make recordings or go on concert tours in the United States and abroad. Somewhat larger numbers of singers obtain leading or supporting roles in operas and popular music shows, or secure engagements as solists in oratorios and other types of performances. Most professional singers of classical music are soloists in churches or synagogues. Some singers also become members of opera and musical comedy choruses or other professional choral groups. Popular music singers perform in musical shows of all kinds—in the movies, on the stage, on radio and television, and in nightclubs and other entertainment places. The best known popular music singers make and sell many recordings.

Since most singers of both classical and popular music have only part time or irregular employment as singers, they often have full-time jobs of other types and sing only in the evenings or on weekends. Some give private voice lessons. A number of singers are employed in elementary and secondary schools, where they are qualified to teach general music courses and lead choruses. Others give voice training or direct choral groups in churches, in music conservatories, or in colleges and universities with schools or departments of music.

Places of Employment

In 1970, about 75,000 people were employed as professional singers or singing teachers. Opportunities for singing engagements are mainly in New York City, Los Angeles, and Chicago—the Nation's chief entertainment centers. Nashville, Tenn., a major center for country and western music, is one of the most important places for employment of singers for both "live" performances and recordings. Persons trained as singers who teach music in elementary and secondary schools, colleges, universities, and conservatories of music are employed throughout the country. Many singers are employed part time, chiefly as church singers and choir masters.

Training and Other Qualifications

Young persons who want to perform professionally as singers should acquire a broad background in music, including its theory and history. The ability to dance may be helpful, since singers are sometimes required to dance. In addition, those interested in a singing career should start piano lessons at an early age. As a rule, voice training should not begin until after the individual has matured physically, although young boys who sing in church choirs receive some training before their voices change. Moreover, because of the work and expense involved in voice training—which often continues for years after the singer's professional career has started—it is important that a prospective singer have great determination. It is also important to audition before a competent voice teacher to decide whether professional training is warranted.

Young people can prepare for careers as singers of classical music by enrolling in a music conservatory, or a school or department of music connected with a college or university, or by taking private voice lessons. These schools provide not only voice training, but other training necessary for understanding and interpreting music, including music-related training in foreign languages and sometimes dramatic training. After completing a 4-year course of study, a graduate may be awarded either the degree of bachelor of music, bachelor of science or arts (in music), or bachelor of fine arts.

Young singers who plan to teach music in public elementary or secondary schools need at least a bachelor's degree with a major in music education and must meet the State certification requirements for teachers. Such training is available in over 550 colleges and universities throughout the country. College teachers usually are required to have a master's degree and sometimes a doctor's degree, but exceptions may be made for especially well-qualified artists.

Although voice training is an asset for singers of popular music, many with untrained voices have had successful careers. The typical popular song does not demand that the voice be developed to cover as wide a range on the musical scale as does classical music, and the lack of voice projection may be overcome by using a microphone.

Young singers of popular songs may become known by participating in amateur and paid performances in their communities. These engagements may lead to employment with local dance bands and possibly later with better known ones.

In addition to musical ability, perseverance, an outstanding personality, an attractive appearance, and good contacts, good luck often is required to achieve a singing career. Singers also may be required to have stamina for traveling to concert and night club engagements. They must be able to adapt to rigorous time schedules, often working night hours.

Employment Outlook

The employment situation for singers will probably remain highly competitive through the 1970's. Competition among popular singers will continue to be especially keen. A great number of short-term jobs are expected in the entertainment field—the opera and concert stage, movies, theater, nightclubs, radio and television, dance bands, and other places—but not enough to provide steady employment for all qualified singers.

Little growth in overall employment opportunities for singers is likely over the long run. The use of recorded music has practically replaced the "live" singer on radio; also, the number of television performances given by singers is limited, although it may increase in future years. However, there is a growing demand for singers to record popular music and commercials for both radio and television advertising. Some additional employment opportunities are expected from the expanded use of cable TV (pay TV). Also, the development and wider use in the future of video cassettes will result in more employment opportunities.

The outlook for singers who can meet State certification requirements for positions as music teachers, or who can qualify for college teaching, will be considerably better than for performers. The demand for music teachers in the Nation's elementary and secondary schools is expected to grow, and some increased employment of music teachers can be expected in colleges and universities. In addition, music teachers will be needed to replace those who will transfer to other fields of work, retire, or die.

A singing career is sometimes relatively short, since it depends on a good voice and public acceptance of the artist, both of which may be affected by age. Due to these circumstances, singers may be subject to unstable employment conditions and the pressure of unreliable financial circumstances.

Earnings and Working Conditions

Except for a few well-known concert soloists, opera stars, top recording artists of popular music, and some singers regularly employed by dance bands and the motion picture industry, most professional singers experience difficulty in obtaining regular employment and have to supplement their singing incomes by doing other types of work.

The salaries of public school music teachers are determined by the salary schedule adopted for all teachers in their school system. The fees that private music teachers charge depend on the teacher's reputation, the economic status of the families in the community, and other factors.

Singers generally work at night and on weekends. School teachers have regular working hours; private voice teachers often give lessons after school or business hours or on weekends. Work in the entertainment field is seasonal and few performers have steady jobs.

Singers who perform professionally usually belong to one branch or another of the AFL-CIO union, the Associated Actors and Actresses of America. Singers who perform on the concert stage or in opera belong to the American Guild of Musical Artists, Inc.; those who sing on radio or television or who make phonograph recordings are members of the American Federation of Television and Radio Artists; singers in the variety and night club field belong to the American Guild of Variety Artists; those who sing in musical comedy and operettas belong to the Actors' Equity Association; and those who sing in the movies belong to the Screen Actors Guild, Inc.

Sources of Additional Information

Information about accredited schools and departments of music may be obtained from:

National Association of Schools of Music, One Dupont Circle, NW., Washington, D.C. 20036.

Further information about music teaching in elementary and secondary schools is available from:

Music Educators National Conference, The National Education Association, 1201 16th St. NW., Washington, D.C. 20036.

Information concerning salary and working conditions in opera and concert fields is available from:

American Guild of Musical Artists, 1841 Broadway, New York, N.Y. 10023.

COMMERCIAL ARTISTS

(D.O.T. 141.031 and .081, 970.281 and .381, and 979.381)

Nature of the Work

A team of commerical artists often creates the artwork in newspapers and magazines and on billboards, brochures, catalogs, and television commericals. The art director supervises this team of artists having varying skills and specializations. He may develop the art aspects of an advertising plan which he turns over to a layout man for further refinement. The *layout artist* constructs or arranges elements of the advertisement, selects and lays out illustrations, photographs, and typography, and determines color and other elements of design. He then prepares a "rough visual" or sketch. After consulting with the director, he may change the visual and complete a more comprehensive layout for the customer.

Working with the layout man in turning out the finished product are a variety of specialists, including *renderers,* who make rough magic marker drawings; *letterers,* who execute appropriate lettering either freehand or with mechanical aids; *illustrators,* who sketch and draw in more finished form; and *paste-up* and *mechanical men,* who cut and paste basic parts of the advertisement or other artwork by using a ruling pen and other drafting tools. Some workers, called *general boardmen,* spend nearly all their time at the drawing board performing many of these specializations. Often supporting the general boardmen or other specialists are apprentices, who primarily do routine jobs such as separating colors and cutting mats.

In a small office, the art director may perform the layout and boardwork with the aid of apprentices. In a large óffice, the art director develops concepts with the copywriter; sets standards; deals with clients; and purchases needed photographs, illustrations, lettering, and other art work from freelancers or art services.

Advertising artists create the concept and artwork for a wide variety of promotional items or "collateral material" including direct mail advertising, catalogs, and counter displays to supplement newspaper and magazine ads or television commercials. They also prepare slides, film strips, and other visual aids.

Commercial artists also create the formats of magazines and other publications, by designing or laying out the editorial pages and features and producing or purchasing the necessary illustrations or artwork. Some commercial artists specialize in fashion illustrations, greeting cards, book illustrations, or in technical drawings for industry.

Places of Employment

An estimated 60,000 commercial artists were employed in 1970; about two-fifths were women. Most commercial artists were employed in big cities, such as New York and Chicago, where the largest users of commercial art are to be found. Some, however, are employed in nearly every city.

Most commercial artists are paid a regular salary as staff artists by advertising agencies, commercial art studios, advertising departments of large companies, printing and publishing firms, textile companies, television and motion picture studios, department stores, and a variety of other business organizations. Many work as freelance artists, selling their artwork to any customer —chiefly to the same types of organizations that employ salaried artists. Some salaried commercial artists also do freelance work in their spare time. A number of commercial artists work for Federal Government agencies, principally in the Defense Department. A few teach in art schools.

Training, Other Qualifications, and Advancement

Artistic ability and good taste are the most important qualifications for success in commercial art, but it is essential that these qualities be developed by specialized training in the techniques of commercial and applied art. In addition, education in the fine arts—painting, sculpture, or architecture—and in academic studies provides a good foundation for obtaining employment in commercial art and may be essential for promotion.

The most widely accepted training for commercial art is the instruction given in art schools or institutes that specialize in commercial and applied art. To enter art school, a high school education usually is required. Some schools admit only applicants who submit acceptable work samples. The course of study, which may include some academic work, generally takes 2 or 3 years, and a certificate is awarded on graduation. A growing number of art schools, particularly those in or connected with universities, require 4 years or more of study and confer a bachelor's degree—commonly the bachelor of fine arts (B.F.A.). In these schools, commercial art instruction is supplemented by liberal arts courses, such as English and history. Limited training in commercial art also may be obtained through public vocational high schools, private home-study schools, and practical experience on the job, but supplemental training usually is needed for advancement.

The first year in art school may be devoted primarily to the study of fundamentals—perspective, design, color harmony, composition—and to the use of pencil, crayon, pen and ink, and other art media. Subsequent study, generally more specialized, includes drawing from life, advertising design, graphic design, lettering, typography, illustrations, and other courses in the student's particular field of interest. Artistic judgment, imagination, and ability to visualize ideas on paper are basic requirements for a successful career in commercial art.

The various specialties, however, differ in some of the specific abilities required. For example, letterers and retouchers must do precise and detailed work requiring excellent coordination, whereas illustrators and designers need imagination, a distinctive art style, and, in most cases, the ability to draw well. Some experience with photography, typography, and printing production is useful in art direction or design. Freelance commercial artists must sell both ideas and finished work to clients. A knowledge of type specifications and printing production is very helpful. Also, a business sense and responsibility in meeting deadlines are assets. Art directors need a strong educational background in art and business practices and the liberal arts. Advertising art directors require a special kind of creativity—the ability to conceive ideas that will stimulate the sale of the clients' products or services.

Beginning commercial artists usually need some on-the-job training to qualify for other than strictly routine work. Advancement is based largely on the individual's artistic talent, creative ability, and education. After considerable experience, may commercial artists leave salaried employment for freelance work. Most illustrators are freelancers; many of them have an agent.

Commercial artists usually assemble their best artwork into a "portfolio," to display their work. A good portfolio is essential in obtaining initial employment and freelance assignments as well as in changing jobs.

Employment Outlook

Employment and advancement opportunities for talented and well-trained commercial artists in most kinds of work are expected to be favorable through the 1970's. Young people having only average ability and little specialized training, however, probably will encounter competition for beginning jobs and will have limited opportunity for advancement.

Employment of commercial artists through the 1970's is expected to increase slowly primarily as a result of the upward trend in business expenditures for visual advertising. This demand includes television graphics, packing design, poster and window displays, and greeting cards. In addition, the expanding field of industrial design is expected to require more qualified artists to do three-dimensional work with engineering concepts. (See statement on Industrial Designers.) In addition to openings that result from growth, some employment opportunities will arise each year from the need to replace commercial artists who retire or leave the field for other reasons.

The demand for commercial artists will continue to vary with the specialization: For example, demand for pasteup and mechanical artists is expected to increase slightly. Jobs for designers, art directors, and layout men are fewer, much sought after, and open only to experienced, highly talented, and creative artists. Fewer staff positions are expected as a result of increased use of highly skilled freelance artists for specialized jobs.

Earnings and Working Conditions

In 1970, beginning commercial artists having no training beyond vocational high school typically earned from $70 to $75 a week; graduates of 2-year professional schools generally received from $80 to $85 a week; and graduates of 4-year post-high school programs typically received $85 to $100 a week, according to the limited data available. Talented artists having strong educational backgrounds and a good portfolio, however, sometimes started at higher salaries. After a few years of experience, qualified artists may expect to earn $125 to $175 a week or more. Art directors, designers, executives, well-known freelance illustrators, and others in top positions generally have much higher earnings, from $15,000 to $20,000 a year or more.

Earnings of freelance artists have an especially wide range, since they are affected by factors such as skill level, variety, and popularity of work, which ultimately effects the amount and price of artwork sold. In 1970, a freelancer received from $25 for a single black and white fashion sketch to $750 for a figure in full color with a background; from $1,000 to $2,000 for a color cover for a national magazine; or from $75 to $300 for a book jacket or record album. Freelance artists may be paid by the hour or by the assignment. Experienced pasteup and mechanical artists may earn at least $4 to $8 an hour.

Salaried commercial artists generally work 35 to 40 hours a week, but sometimes they must work additional hours and under a considerable amount of pressure in order to meet deadlines. Freelance artists usually have irregular working hours.

Sources of Additional Information

Additional information on employment opportunities in commercial art may be obtained from:

National Art Education Association,
National Education Association,
1201 16th St. NW., Washington,
D.C. 20036.

INDUSTRIAL DESIGNERS

(D.O.T. 142.081)

Nature of the Work

Industrial designers combine technical knowledge of materials, machines, and methods of production with artistic talent to improve the appearance and functional design of machine-made products. Since the consuming public has wide choice of styles in products such as radios, television sets, automobiles, refrigerators, and furniture, a primary objective of the industrial designer is to design his own employer's product to compete favorably with similar goods on the market.

As a first step, the industrial designer does historical research on the product or related products. He studies competition in the market and the different ways in which the product may be used. Then, he sketches a variety of possible designs, which are examined by various departments. For example, the designer consults his company's engineers, production supervisors, and sales and market research staffs for their opinions on the practicability of producing a newly designed product, or changing the design of an old product, as well as the sales potential of the proposed designs. After the most suitable design is selected by company officials, a model may be made by the designer. The first model of a new design is often made of clay so that it can be altered easily to reflect modifications. The final or working model is usually made of the material to be used in the finished product. If the model is approved in this form, it is put into production.

Industrial designers also may do related types of work. For example, they may design containers and packages, prepare small exhibits for display purposes, or design the entire layout for industrial fairs. Some also design the interior layout of special purpose commercial buildings, such as gasoline stations and supermarkets.

Industrial designers employed by a manufacturing company usually find their work limited to the one or few products made by their employer; many senior designers, however, are now given a free hand to engage in long-range planning for new or diversified products. Designers who work as consultants to more than one industrial firm, either as freelance designers or as members of consulting firms, may plan and design a great variety of products.

Places of Employment

Most of the estimated 10,000 industrial designers in 1970 were employed by large manufacturing companies and by design consulting firms. Of the remainder, the greatest number did freelance work or combined salaried employment with it. Some also worked for architects, and a few were on the staffs of firms of interior designers.

Industrial designers employed by consulting firms are located mainly in large cities. For example, the New York and Chicago areas have the largest number of design consulting organizations. Those employed by industrial firms are found in small and middle size cities as well, since most work in the decentralized manufacturing plants of their companies.

Training, Other Qualifications, and Advancement

The completion of a course of study in industrial design—in an art school, an art department of a university, or a technical college—is the usual requirement for entering this field of work. People from other areas, however, notably engineering and architecture, may qualify as industrial designers if they have appropriate experience and artistic talent.

Formal education in industrial design at the college or university level usually takes 4 years to complete, and a few schools require 5 years of study. These schools award the bachelor's degree in industrial design or fine arts; about half of these schools also award the master's degree for advanced study in the field. A few schools, usually private art schools or those associated with large art museums, offer a 3-year course of study in industrial design which leads to a diploma. In the past few years, however, most art and museum schools have moved toward accreditation or affiliation with a university, usually offering a 4-year program and a bachelor's degree.

Entrance to the course of study in industrial design is limited, with rare exceptions, to qualified high school graduates; in addition, some schools may require students to present sketches and other examples of their artistic ability. Some schools also require students to complete their freshman or sophomore years before they select an industrial design major.

Industrial design curriculums differ considerably among schools. Some schools stress the engineering and technical aspects of the field, and others give students a strong cultural background in art. Nevertheless, most industrial design curriculums include at least one course in two-dimensional design (color theory, spatial organization, etc.) and one in general three-dimensional design (abstract sculpture and art structures), including a substantial amount of studio practice in the actual design of three-dimensional products. In the studio course, students learn to make working drawings and models with clay, wood, plaster, and other easily worked materials. In schools that have the necessary machinery, students gain experience in making models of their designs while learning to use metalworking and woodworking machinery. Some schools require the completion of courses in basic engineering and in the composition of materials. All schools which offer 4- or 5-year courses leading to a bachelor's degree also include academic subjects, such as English, history, psychology, economics, and science in their curriculums.

Creative ability, skill in drawing, and the ability to anticipate consumer needs are the most important personal qualifications needed by young people aspiring to work in this field. A mechanical interest also is desirable for some types of work. Applicants for jobs will find it helpful to have previously assembled a "portfolio" which demonstrates their skill in designing and their creative talent. Since industrial designers are required frequently to work cooperatively with engineers and other staff members, the ability to work and communicate well with others is important. Those who plan to practice industrial designing on a consulting basis should have a knowledge of business practices and possess sales ability.

New graduates of industrial design courses frequently start as assistants to experienced designers. They are usually given relatively simple assignments which do not involve making structural changes in the product. As they gain experience, designers may be assigned to supervisory positions with major responsibility for the design of a product or a group of products. Those who have an established reputation in the field, as well as the necessary funds, may start their own consulting firms.

Employment Outlook

Employment in this relatively small occupation is expected to expand moderately through the 1970's. Employers will be actively seeking applicants having a college degree and outstanding talent. Some employment opportunities also will arise each year from the need to replace designers who retire or leave the field for other reasons.

A number of factors will affect employment of industrial designers. Rapid obsolescence of household and commercial equipment and the rising population will increase the demand for newly designed products. As in the past, manufacturers will strive to hold or increase their share of these markets through the creation of new products, improvements in the design of existing ones, and change in package designs and other modernizations in the appearance and use of their products. Small companies probably will make increasing use of services offered by industrial design consulting firms to compete more effectively with larger firms. All these factors, in addition to rising per capita income, will contribute to the long-term growth in the employment of industrial designers. However, as in the past, new entrants trained specifically in industrial designing are likely to encounter keen competition for beginning jobs from persons with engineering, architectural, and related educational backgrounds who have artistic and creative talent.

Earnings and Working Conditions

Starting salaries for inexperienced industrial designers employed by manufacturing firms ranged from $125 to $150 a week in 1970, according to the limited information available. Beginning salaries for those employed by consulting firms were usually lower. Salaries of experienced industrial designers vary greatly, depending on such factors as individual ability, and size and type of firm in which employed. Those having several years of experience earned salaries ranging from $8,000 to $14,000 annually. Some large manufacturing firms paid $25,000 or more to experienced and talented designers.

Earnings of industrial designers who own their consulting firms, alone or as members of a partnership, vary widely, and may fluctuate markedly from year to year. In recent years, earnings of most consultants were between $12,000 and $25,000 and heads of large well-known firms earned considerably more.

Sources of Additional Information

General information about careers in industrial design and a list of schools offering courses and degrees in industrial design may be obtained from:

Industrial Designers Society of America, 60 West 55th St., New York, N.Y. 10019.

INTERIOR DESIGNERS AND DECORATORS

(D.O.T. 142.051)

Nature of the Work

The creative work of interior designers and decorators enhances the attractiveness of our homes and other buildings. Designers and decorators plan the functional arrangement of interior space and coordinate the selection (including colors) of furniture, draperies and other fabrics, floor coverings, and interior accessories. They may work on the interiors of residential or commercial structures, as well as on ships and aircraft. Some design stage sets used for motion pictures and television. Interior designers are more involved than decorators in space planning and other interior design; they often work for clients on large design projects such as the interiors of entire office buildings, hospitals, and libraries. Generally, their plans include the complete layout of the rooms within the space allowed by the exterior walls and other framework. Sometimes they redesign the interiors of old structures. When their plans have been completed, the architect checks them against his blueprints to assure compliance with building requirements and to solve structural problems. Some interior designers also design the furniture and accessories to be used in interiors and then arrange for their manufacture.

Many professionals in this field have their own establishments, either alone or as a member of a firm with other designers and decorators; they may sell some or all of the merchandise with which they work. Some work independently or as assistants; others have large staffs, sometimes including salespeople.

Many of the larger department and furniture stores have separate departments of interior decorating or interior design, or both, to advise customers on decorating and design plans. The main function of these departments is to help sell the store's own merchandise, although materials from outside sources may be used when they are essential to the plans developed for the customer. Department store decorators and designers frequently advise the stores' buyers and executives about style and color trends in interior furnishings.

Interior designer helps client select fabric.

Interior designers and decorators usually work directly with clients to determine preferences and needs in furnishings. They may do "boardwork," particularly on large assignments, which includes work on floor plans and elevations and the creation of sketches, or other perspective drawings in such media as watercolor, pastels, or tempera, so clients can visualize their plans. They also provide cost estimates. After the client approves both the plans and the cost estimates, arrangements are made for the purchase of the furnishings; for the supervision of the work of painters, floor finishers, cabinetmakers, carpetlayers, and other craftsmen; and for the installation and arrangement of furnishings.

Places of Employment

More than 15,000 people were engaged full time in interior design and decoration in 1970. About half were women. Men, however, predominate in the interior design field. Many in design and decorating work on a part-time basis.

Most workers in this field are located in large cities. In recent years, large department and furniture stores have become increasingly important sources of employment for professional interior designers and decorators. Some designers and decorators have permanent jobs with hotel and restaurant chains. Others are employed by designers of space like architects or suppliers of furniture and materials for use in the space, like antique dealers, office furniture stores, furniture and textile manufacturers, or other manufacturers in the interior furnishings field. They may also work for periodicals that feature articles on homefurnishings. Some large industrial corporations employ interior designers on a permanent basis.

Training, Other Qualifications, and Advancement

Formal training in interior design and decoration is becoming increasingly important for entrance into this field of work, although many present members of the profession achieved success without this training. Most department stores, well-established design and decorating firms, and other major employers will accept only professionally trained people for beginning jobs. Usually, the minimum educational requirement is completion of either a 2- or 3-year course at a recognized art school or institute specializing in interior decorating and design, or a 4-year college course leading to a bachelor's degree with a major in interior design and decoration. The course of study in interior design and decoration usually includes the principles of design, history of art, freehand and mechanical drawing, painting, the study of the essentials of architecture as they relate to interiors, design of furniture and exhibitions, and study of various materials, such as woods, metals, plastics, and fabrics. A knowledge of furnishings, art pieces, and antiques is important. In addition, courses in salesmanship, business procedures and other business subjects are of great value.

Membership in either the American Institute of Interior Designers (AID) or the National Society of Interior Designers (NSID), both professional societies, is a recognized mark of achievement in this profession. Membership usually requires the completion of 3 or 4 years of post-high school education, the major emphasis having been on training in design, and several years of practical experience in the field, including responsibility for supervision of all aspects of decorating contracts.

New graduates having training in interior design and decorating usually serve a training period, either with decorating firms, in department stores, or in the firm of an established designer. They may act as receptionists, as shoppers with the task of matching materials or finding accessories, or as stockroom assistants, assistant decorators, or junior designers. In most instances, from 1 to 3 years of on-the-job training is required before a trainee is considered eligible for advancement to the job of decorator. Beginners who do not obtain trainee jobs often work as salespeople for fabric, lamp, or other interior furnishings concerns to gain experience in dealing with customers and to become familiar with the merchandise. This experience often makes it easier to obtain trainee jobs with a decorating firm or department store; it also may lead to a career in merchandising.

After considerable experience, decorators and designers with ability may advance to decorating or design department head, interior furnishings coordinator, or to other supervisory positions in department stores or in large decorating or design firms; if they have the necessary funds, they may open their own establishments. Talented people usually advance rapidly.

Artistic talent, imagination, good business judgment, and the ability to deal with people are important assets for success in this field.

Employment Outlook

Talented art school or college graduates who major in interior design will find good opportunities for employment through the 1970's. Applicants who can design and plan the functional arrangement of interior space will be in strong demand. Young people without formal training will find it increasingly difficult to enter the field.

A slow but steady increase in employment of interior designers and decorators is anticipated through the 1970's. Population growth, larger expenditures for home and office furnishings, the increasing availability of well-designed furnishings at moderate prices, a growing recognition among middle-income families of the value of decorators' services, and increasing use of design services for commercial establishments should contribute to a greater demand for these workers. In addition to newly created jobs, some openings will arise each year from the need to replace designers and decorators who die, retire, or leave the field for other reasons.

Department and furniture stores are expected to employ an increasing number of trained decorators and designers. These stores also are expected to share in the growing volume of design and decorating work for commercial establishments and public buildings, formerly handled almost entirely by independent decorators. This development will result in increased opportunities in salaried employment. Interior design firms also are expected to continue to expand. However, employment of interior decorators and designers is sensitive to changes in general economic conditions because people often defer this kind of expenditure when the economy slows down.

Earnings and Working Conditions

Beginning salaries ranged generally from $75 to $90 a week in 1970 for art school or college graduates having formal training in interior design and decoration; some graduates of 3- or 4-year design schools received salaries of $100 or more a week, according to limited data available.

Some designers and decorators are paid straight salaries; some receive salaries plus commissions which usually range from 5 to 10 percent of the value of their sales; others receive commissions only, which may be as much as one-third of the value of their sales.

Many interior decorators having only average skill in this field earn only moderate incomes—from $5,000 to $7,500 a year, even after many years of experience. Talented decorators who are well known in their localities may earn up to $15,000 or more. Designers and decorators whose abilities are nationally recognized may earn well beyond $25,000 yearly.

Self-employed decorators have an especially wide range of earnings; their profits are related to factors such as the volume of business, their prestige as decorators, economic level of their clients, their own business competence, and the percentage of wholesale prices they receive from the sale of furnishings.

Hours of work for decorators are sometimes long and irregular. They usually adjust their workday to suit the needs of their clients, meeting with them during the evenings or on weekends, when necessary. Designers' schedules follow a more regular workday pattern.

Sources of Additional Information

Information about employment and scholarship opportunities may be obtained from:

National Society of Interior Designers, Inc., 315 East 62nd Street, New York, N.Y. 10021.

SOCIAL SCIENCES

The social sciences are concerned with all aspects of human society from the origins of man to the latest election returns. Social scientists, however, generally specialize in one major field of human relationships. Anthropologists study primitive tribes, reconstruct civilizations of the past, and analyze the cultures and languages of all peoples, past and present. Economists study the allocation of land, labor, and capital. Geographers study the distribution throughout the world of people, types of land and water masses, and natural resources. Historians describe and interpret the people and events of the past and present. Political scientists study the theories, objectives, and organizations of all types of government. Sociologists analyze the behavior and relationships of groups—such as the family, the community, and minorities—to the individual or to society as a whole.

Besides these basic social sciences, a number of closely related fields are covered in separate statements elsewhere in this *Handbook*. (See statements on Statisticians, Psychologists, and Social Workers.)

About 80,000 persons were employed professionally in the basic social sciences in 1970; about 1 out of 10 was a woman. Overlapping among the basic social science fields and the sometimes hazy distinction between these and related fields such as business administration, foreign service work, and high school teaching, make it difficult to determine the exact size of each profession. Economists, however, are the largest social science group, and anthropologists the smallest.

Most social scientists are employed by colleges and universities. A large number are employed by the Federal Government and private industry. The trend in some industries is to hire increasing numbers of social science majors as trainees for administrative and executive positions. Research councils and other nonprofit organizations provide an important source of employment for economists, political scientists, and sociologists.

Employment in the social sciences has been increasing and is expected to grow very rapidly through the 1970's, mainly because of the anticipated rise in college teaching positions. The reasons for this expected increase are discussed in the statement on College and University Teachers. A rise in employment in government also is expected. Employment in government agencies often is greatly affected by changes in public policy. For example, more social scientists will be needed to handle research and administrative functions resulting from programs established by Congress to relieve unemployment and eliminate poverty. Rising employment of social scientists in private industry and nonprofit organizations also is expected. In addition, several thousand social scientists will be needed each year to replace those who leave the field because of retirement, death, or other reasons.

Social scientists having doctor's degrees will find favorable employment opportunities through the 1970's in both teaching and nonteaching positions. For those having less training, the outlook is different for the various fields and is discussed in the statements that follow.

ANTHROPOLOGISTS

(D.O.T. 055.088)

Nature of the Work

Anthropologists study man, his origins, physical characteristics, culture, traditions, beliefs, customs, languages, material possessions, and his structured social relationships and value systems. Although anthropologists may specialize in any one of these areas, they are expected to have a general knowledge in all of them.

Most anthropologists specialize in cultural anthropology sometimes called ethnology. *Ethnologists* may spend long periods living with tribal groups or in other communities, to learn about their ways of life. The ethnologist takes detailed and comprehensive notes describing the social customs, beliefs, and material possessions of the people. He usually learns their language in the process. He may make comparative studies of the cultures and societies of various groups. In recent years, his investigations have included complex urban societies.

Archeologists excavate the places where people lived in the past to reconstruct their history and customs by studying the remains of homes, tools, clothing, ornaments, and other evidences of human life and activity. For example, archeologists are digging in the Pacific Coast area between northern Mexico and Ecuador to find evidences of trade and migration in the pre-Christian Era. Some archeologists are excavating ancient Mayan cities in Mexico and restoring temples. Others are working in the Missouri River valley to salvage remnants of Indian villages and sites of early military forts and trading posts.

Some anthropologists specialize in *linguistics,* the scientific study of

Anthropologist examines item obtained on field trip.

the sounds and structures of languages and of the historical relationships among languages. They study the relationship between the language and the behavior of people, and their work assists in reconstructing the prehistory of mankind.

Physical anthropologists apply intensive training in human anatomy and biology to the study of human evolution, and to the scientific measurement of the physical differences among the races and groups of mankind as influenced by heredity and environment. Because of their knowledge of body structure, physical anthropologists occasionally are employed as consultants on projects such as the design of driver seats, space suits, cockpits for airplanes and spaceships, and the sizing of clothing. They may consult on projects to improve environmental conditions and on criminal cases. They are increasingly employed in medical schools.

Most anthropologists teach in colleges and universities and often combine research with their teaching. Some anthropologists specialize in museum work, which generally combines management and administrative duties with fieldwork and research on anthropological collections. A few are engaged primarily in consulting, nontechnical writing, or other activities.

Places of Employment

About 3,100 people were employed as anthropologists in 1970. About a fifth of them were women. Most anthropologists were employed in colleges and universities. Several hundred worked in private industry and nonprofit organizations. The Federal Government employed a small number, chiefly in museums, national parks, in the Bureau of Indian Affairs, and in technical aid programs. State and local government agencies also employed some anthropologists, usually for museum work or health research.

Training, Other Qualifications, and Advancement

Young people who are interested in careers in anthropology should obtain Ph. D. degrees. College graduates with bachelor's degrees often obtain temporary positions and assistantships in the graduate departments where they are working for advanced degrees. A master's degree, plus field experience, is sufficient for many beginning professional positions, but promotion to top positions is generally reserved for individuals holding the Ph. D. degree. In many colleges and most universities, only anthropologists holding the Ph. D. degree can obtain permanent teaching appointments.

Some training in both physical and cultural anthropology is necessary for all anthropologists. Mathematics is helpful since statistical methods and computers are becoming more widely used for research in this field. Undergraduate students may begin their field training in archeology by arranging, through their university department, to accompany expeditions as laborers or to attend field schools established for training. They may advance to supervisor in charge of the digging or collection of material and finally may direct a portion of the work of the expedition. Ethnologists and linguists usually do their fieldwork alone, without direct supervision. Most anthropologists base their doctoral dissertations on data collected through field research; they are, therefore, experienced fieldworkers by the time they obtain the Ph. D. degree.

In 1970, departments of anthropology in the U.S. numbered over 200. Most universities having graduate programs also offer undergraduate training in anthropology. The choice of a graduate school is very important. Students interested in museum work should select a school that can provide experience in an associated museum having anthropological collections. Similarly, those interested in archeology should choose a university that offers opportunities for summer experience in archeological fieldwork or should plan to attend an archeological field school elsewhere during their summer vacations.

Young people planning careers in anthropology should have an above average interest in natural history or social studies and enjoy reading, research, and writing. A desire to travel and the ability to cope with the disadvantages of remote work areas are sometimes necessary for success.

Employment Outlook

The number of anthropologists is expected to increase rapidly through the 1970's. The largest increase in employment will be in the college teaching field. Some additional positions will be found in museums, archeological research programs, mental and public health programs, and in community survey work. Opportunities in other fields are likely to be limited largely to the replacement of personnel who retire, die or leave their positions for other reasons.

Anthropologists holding the doctorate are expected to have good employment opportunities through the 1970's. Graduates with only the master's degree are likely to face persistent competition for professional positions in anthropology and may enter related fields of work. A few who meet certification requirements may secure high school teaching positions. Others may find jobs in public administration and in nonprofit organizations and civic groups, which prefer personnel with social science training as a general background.

Earnings and Working Conditions

In 1970, starting salaries for anthropologists having a Ph. D. generally ranged between $8,000 and $10,000 a year. Experienced anthropologists may earn twice that amount. Anthropologists employed by educational institutions received a median salary of $15,500 for the calendar year or $14,000 for the academic year, according to the National Science Foundation's National Register of Scientific and Technical Personnel.

In the Federal Government, the starting salary was $9,881 for anthropologists having an M.A and $11,905 for those having a Ph. D. Experienced anthropologists earned from $14,000 to more than $20,000 a year.

Many anthropologists employed in colleges and universities supplement their regular salaries with earnings from other sources such as summer teaching and research grants.

Anthropologists doing archeological fieldwork sometimes are required to work in adverse weather conditions and perform manual labor. They also must adapt themselves to cultural environments which are materially and socially different.

Sources of Additional Information

Additional information concerning employment opportunities and schools offering graduate training in anthropology may be obtained from:

The American Anthropological Association, 1703 New Hampshire Avenue, NW., Washington, D.C. 20009.

Specific inquiries about anthropology as a career may be addressed to:

Smithsonian Institution, Washington, D.C. 20560.

ECONOMISTS

(D.O.T. 050.088)

Nature of the Work

Economists study the problems that arise in the utilization of limited resources of land, raw materials, and manpower to provide goods and services. In this connection, they may analyze the relation between the supply of and demand for goods and services, and the ways in which goods are produced, distributed, and consumed. Some economists are concerned with practical problems such as the control of inflation, the prevention of depression, and the development of farm, wage, tax, and tariff policies. Others develop theories to explain the causes of employment and unemployment or the ways in which international trade influences world economic conditions. Still others collect and interpret data on a wide variety of economic problems.

Economists employed in colleges and universities teach the principles and methods of economics and conduct or direct research. They frequently engage in writing and consulting and formulate many of the new ideas that directly or indirectly influence government and industry planning.

Economists in government plan and carry out studies for use in assessing economic conditions and the need for changes in government policy. Their work may include the collection of basic data, analysis, and the preparation of reports. Most government economists are in the fields of agriculture, business, finance, labor, or international trade and development.

Economists employed by business firms provide management with in-

formation for decision making on matters such as markets for and prices of company products, the effect of government policies on business or international trade, the advisability of adding new lines of merchandise, opening new branch operations, or otherwise expanding the company's business.

Places of Employment

Economics is the largest of the basic social science fields. About 33,000 economists were employed in 1970. Industry and business employed more than one-half; colleges and universities, more than one-fourth; and government agencies—chiefly Federal—roughly one-sixth. A few were self-employed, or worked for private research organizations.

Economists are found in all large cities and in university towns. The largest numbers are in the New York and Washington, D.C. metropolitan areas. Some are employed overseas, mainly by the U.S. Department of State and the Agency for International Development.

Training, Other Qualifications, and Advancement

Economists must have a thorough grounding in economic theory and methods of economic analysis. An increasing number of universities also emphasize the value of mathematical methods of economic analysis. Since many beginning jobs for economists in government and business involve the collection and compilation of data, a thorough knowledge of basic statistical procedures usually is required.

A bachelor's degree with a major in economics is sufficient for many beginning research jobs in government and private industry, although persons employed in such entry jobs are not always regarded as professional economists. In the Federal Government, candidates for entrance positions must have a minimum of 21 semester hours of economics and 3 hours of statistics, accounting, or calculus.

Graduate training is very important for young people planning to become economists. Students interested in research should select schools that emphasize training in research methods and statistics and provide good research facilities. Those who wish to work in agricultural economics will find good opportunities to gain experience in part-time research work at State universities having agricultural experiment stations.

The master's degree generally is required for appointment as a college instructor, although in large schools graduate assistantships sometimes are awarded to superior students working toward their master's degree. In many large colleges and universities, completion of all the requirements for the Ph. D. degree, except the dissertation, is necessary for appointment as instructor. In government or private industry, economists holding the master's degree usually can qualify for more responsible research positions than are open to those having only the bachelor's degree.

The Ph. D. degree is required for a professorship in a high-ranking college or university and is an asset in competing for other responsible positions in government, business, or private research organizations.

Persons considering a career as an economist should be accurate, like details, and prepared to spend much time doing research. Frequently, the ability to work as part of a team is required. Economists must be objective in their work and have oral and writing skills.

Employment Outlook

Employment of economists is expected to increase rapidly through the 1970's. Colleges and universities will need hundreds of new instructors annually to handle an anticipated rapid increase in enrollments and to replace economists who retire, die, or transfer to other fields of work. Employment of economists by industry is expected to increase rapidly as businessmen become more accustomed to rely on scientific methods of analyzing business trends, forecasting sales, and planning purchasing and production operations. Employment of economists at the Federal, State, and local levels also will increase rapidly to meet the need for more extensive data collection and analysis, and to provide the staff for programs aimed at reducing unemployment and poverty.

Economists having the doctorate are expected to have very good opportunities for employment. Employment opportunities for economists having a master's degree will be favorable, especially for those with good training in statistics and mathematics. Young people having bachelors' degrees in economics may find employment in government and as management trainees in industry and business.

Earnings

According to the National Science Foundation's National Register of Scientific and Technical Personnel, the median salary of economists employed by colleges and universities in 1970 was $18,000. The median salary for those in business, industry, and nonprofit organizations was $20,000. Economists having Ph. D.'s were paid higher salaries than those who have lesser degrees and similar experience. A substantial number of economists supplement their basic salaries by consulting, teaching, and other activities.

In the Federal Government, the entrance salary in 1970 for beginning economists having a bachelor's degree was $6,548; however, those with superior academic records could begin at $8,098. Those having 2 full years of graduate training or experience could qualify for positions at an annual salary of $9,881. Most experienced economists in the Federal Government earned from $14,000 to $23,000 a year; some having greater administrative responsibilities earned considerably more.

Sources of Additional Information

Additional information on a career as an economist is available from:

American Economic Association,
1313 21st Avenue South, Nashville,
Tenn. 37212.

Additional information on employment opportunities in economics and related fields is given in the following publications:

The Foreign Service in the Seventies, U.S. Department of State, Publication 8535, Washington, D.C. 20520. Free.

The International Developer (Economist), Professional Talent Search, Office of Personnel and Manpower, Agency for International Development, Washington, D.C. 20523. Free.

GEOGRAPHERS

(D.O.T. 029.088 and 059.088)

Nature of the Work

Geographers study the spatial characteristics of the earth's terrain, minerals, soils, water, vegetation, and climate. They relate these characteristics to changing patterns of human settlement—where people live, why they are located there, and how they earn a living.

The majority of geographers are engaged in college and university teaching; some may combine teaching and research. This research may include the study and analysis of the distribution of land forms, climate, soils, vegetation, and mineral and water resources, sometimes utilizing surveying and meteorological instruments. They also analyze the distribution and structure of political organizations, transportation systems, marketing systems, and urban systems. Many geographers spend considerable time in field study, and in analyzing maps, aerial photographs, and observational data collected in the field. Photographs and other data from remote sensors on satellites are used increasingly. Other geographers construct maps, graphs, and diagrams.

Most geographers specialize in one main branch or more of geography. Those working in *economic geography* deal with the geographic distribution of economic activities—including manufacturing, mining, farming, trade, and communications. *Political geography* is the study of the way political processes affect geographic boundaries on subnational, national, and international scales, and the relationship of geographic conditions to political processes. *Urban geography*, a

growing field for geographers, is concerned with the study of cities and community planning. (See statement on Urban Planners.) Specialists in *physical geography* study the earth's physical characteristics and those of the moon as well. *Regional geography* pertains to all the physical, economic, political, and cultural characteristics of a particular region or area, which may range in size from a river basin or an island, to a State, a country, or even a continent. Geographers in the field of *cartography* design and construct maps, as well as compile data for them.

Many geographers have job titles which describe their specialization, such as cartographer, map cataloger, or regional analyst, rather than the title geographer. Others have titles relating to the subject matter of their study such as photo-intelligence specialist or climatological analyst. Still others have titles such as community planner, market or business analyst, or intelligence specialist. Most of those who teach in colleges and universities are called geographers.

Places of Employment

An estimated 7,100 geographers were employed in the United States in 1970; about 15 percent were women.

More than two-thirds of all geographers are employed by colleges and universities. Those teaching in institutions which do not have separate departments of geography usually are associated with departments of geology, economics, or other physical or social sciences.

The Federal Government employs a large number of geographers. Among the major agencies employing these workers are the United States Army Topographic Command and other defense related agencies; the Department of the Interior; and the Department of Commerce. State and local governments also employ a small number of geographers, mostly on city and State planning and development commissions.

Most of the relatively small but growing number of geographers employed by private industry work for marketing research organizations, map companies, textbook publishers, travel agencies, manufacturing firms, or chain stores. A few geographers work for scientific founda-firms, or chain stores. A few geogra-tions and research institutes. A small number are employed as map librarians.

Training, Other Qualifications, and Advancement

The minimum educational requirement for beginning positions in geography usually is a bachelor's degree with a major in the field. For most positions in research and teaching, and for advancement in many other types of work, graduate training is required.

Training leading to the bachelor's degree in geography was offered by 400 colleges and universities in 1970. Undergraduate study usually provides a general introduction to geographic knowledge and research methods and often includes some field studies. Typical courses offered are physical and cultural geography, weather and climate, economic geography, political geography, urban geography, location analysis, quantitative methods, and regional courses, such as the geography of North America, Western Europe, the U.S.S.R., and Asia. Courses in cartography and in the interpretation of maps and aerial photographs are offered also.

In 1970, 165 institutions offered training leading to the master's degree, and 55 offered the Ph. D. For admittance to a graduate program in geography, a bachelor's degree with a major in geography is the usual requirement. However, most universities admit students with bachelor's degrees in any of the social or physical sciences, some if they have background in geography. Requirements for advanced degrees include field and laboratory work, as well as classroom studies and thesis preparation.

New graduates having only the bachelor's degree in geography usually find positions connected with making, interpreting, or analyzing maps; or in research, either working for the government or industry. Others enter beginning positions in the planning field. Some obtain employment as research or teaching assistants in educational institutions while studying for advanced degrees. Some earn library science degrees and become map librarians. New graduates having the master's degree can qualify for some teaching and research positions in colleges and for many research positions in government and industry. The Ph. D. degree usually is required for high-level posts in college teaching and research and may be necessary for advancement to top-level positions in other activities.

Young persons considering a career as a geographer should be prepared for a life of reading, studying, and research. New research methods used by the geographer require some mathematical abilities and knowledge of computer capabilities. As with all the sciences, geographers must be willing to work with ideas and theories and should be originative. They must be able to express themselves clearly.The ability to work independently is important.

Employment Outlook

The employment outlook for geographers is expected to be favorable through the 1970's. The demand will be especially strong for geographers having the Ph. D. to fill research and teaching positions in colleges and universities and research jobs in industry and government. Those having the master's degree are likely to find some competition. Geographers with advanced training in fields such as economics or business administration also will be in strong demand.

Colleges and universities are expected to offer the greatest number of employment opportunities as college enrollments increase very rapidly through the 1970's. Rising interest in foreign countries and growing awareness of the value of geography training in several other fields of work, such as the foreign service, should also result in increased enrollments in geography and in a need for additional teachers at the college level. A growing demand for geography teachers in secondary schools also is anticipated.

Employment of geographers in government is also likely to increase. The Federal Government may need additional personnel in positions related to regional development; urban planning; resource management; planning, construction, and interpretation of maps; and in intelligence work. State and local government employment of geographers also will expand, particularly in areas such as conservation, highway planning, and city, community, and regional planning and development.

The number of geographers employed in private industry also is expected to rise. Market research and location analysis should continue to grow rapidly. Opportunities also should increase in private area planning and development work.

Earnings and Working Conditions

In the Federal Government in 1970, geographers having the bachelor's degree and no experience started at $6,548 or $8,098 a year, depending on their college record. Geographers having 1 or 2 years of graduate teaching could start at $8,098 or $9,881; and those having the Ph. D. degree, at $11,905.

In colleges and universities, salaries of geographers depend on their teaching rank. Assistant professors entering the field with a Ph. D. received at least $11,500 in 1970. Experienced professors frequently earned $20,000. (For further information, see statement on College and University Teachers.) Geographers in educational institutions usually have an opportunity to earn income from other sources, such as consulting work, special research projects, and publication of books and articles.

Working conditions of most geographers are similar to those of other teachers and office workers. Geographic research frequently requires extensive travel in foreign countries, as well as in the United States.

Sources of Additional Information

Association of American Geographers, 1710 16th St. NW., Washington, D.C. 20009.

HISTORIANS

(D.O.T. 052.088)

Nature of the Work

History is the record of the past —past events, institutions, ideas, people. Historians use these records to describe and analyze this past—through writing and teaching, for instance. They also may relate this knowledge of the past to current events, in an effort to explain the present.

Historians may specialize in the history either of a specific country or area, or in a particular period of time—ancient, medieval, or modern. They may specialize also in the history of a field, such as economics, culture, military affairs, the labor movement, art, or architecture. The number of specialties in history is constantly growing. Newer fields include the history of business and of the relationship between technological and other aspects of historical development. In this country, most historians still specialize in the political history of either the United States or modern Europe; however, a growing number are now specializing in African, Latin American, Asian, or Near Eastern history. Some historians also specialize in phases of a larger historical field, such as Civil War history or Ancient Greek civilization.

Most historians are employed as college teachers who may also write, lecture, or take part in research. Some, called *archivists,* work with documentary materials of historical value, and specialize in identifying and preserving them and making them available. Other historians specialize in writing or editing historical materials, preparing exhibits, or speaking for museums, special libraries, and historical societies. A few serve as consultants to editors, publishers, and producers of materials for radio, television, and motion pictures. Historians are employed by governments mainly in connection with research projects, as researchers or administrators; they also may prepare studies, articles, and books on research findings.

Economic historian uses trend data in analysis.

Places of Employment

About 15,500 persons were employed as historians in 1970. Approximately 85 percent of all historians were employed in colleges and universities. About 4 percent were employed in Federal Government agencies, principally the National Archives and the Departments of Defense, Interior, and State. Small but growing numbers were employed by other government organizations (State, local, and international), by nonprofit foundations, research councils, special libraries, State historical societies, museums, and large corporations.

Since history is taught in all U.S. institutions of higher education, historians are found in all college communities. Many of the historians in the Federal Government are employed in Washington, D.C. Historians in other types of employment usually work in localities which have museums or libraries with collections adequate for historical research.

Training, Other Qualifications, and Advancement

Graduate education usually is necessary for employment as an historian. A master's degree in history is the minimum requirement for the position of college instructor. In many colleges and universities, however, a Ph.D. degree is essential for high-level teaching, research, and administrative positions. Most historians in the Federal Government and in nonprofit organizations have Ph.D. degrees, or their equivalent in training and experience.

Although for some beginning jobs in government—either Federal, State, or local—a bachelor's degree with a major in history is sufficient training; persons in such jobs may not be regarded as professional historians. A knowledge of archival work is helpful, since these beginning jobs are likely to be concerned with collection and preservation of historical data. For jobs in international relations and journalism, an undergraduate major in history is considered helpful.

Employment Outlook

Employment in this relatively small occupation is expected to increase rapidly through the 1970's. At the college level, hundreds of new history teachers probably will be needed annually, because of expanding enrollments, as well as to replace those faculty members who retire, die, or leave for other types of work. In archival work, the number of positions for historians also is expected to rise, although more slowly.

With the doctorate, historians are expected to have relatively favorable employment opportunities through the 1970's, although they may face increasing competition for jobs in college teaching. Historians having only the master's degree probably will encounter considerable competition. Others will find it difficult to obtain professional positions as historians. On the other hand, history majors who meet State school certification requirements may find openings in high school teaching. Some history majors also qualify as administrative and management trainees in government agencies, foundations, civic organizations, and private industry.

Earnings

The average (median) salary of historians employed by colleges and universities was $12,200 in 1970 according to the limited data available. In the Federal Government, the starting salary for persons having a bachelor's degree was $6,548 in 1970. Those having a superior academic record or a year of graduate training were eligible for positions at an annual salary of $8,098. The median annual salary for historians employed by the Federal Government in 1970 was about $14,000.

Some historians, particularly those in college teaching, supplement their income by summer teaching or writing books or articles. A few earn additional income from lectures.

Sources of Additional Information

Additional information on employment opportunities for historians may be obtained from:

American Historical Association,
400 A St. SE., Washington, D.C.
20003.

POLITICAL SCIENTISTS

(D.O.T. 051.088)

Nature of the Work

Political science is the study of government—what it is, what it does, and how and why. Political scientists are interested in government at every level—local, county, State, regional, national, and international. Many of them specialize in one general area of political science, such as political theory, U.S. political institutions and processes, comparative political institutions and processes, or international relations and organizations. Some specialize in a particular type of political institution or in the politics of a specific era.

Political scientists are employed most frequently as college and university teachers. They may combine research, consultation, or administrative duties with teaching. Some teach at universities in other countries, where they prepare students for careers in public administration and assist in the development of training programs for government personnel. Many political scientists are engaged mainly in research. They may survey public opinion on political questions for private research organizations. They may study proposed legislation for State or municipal legislative reference bureaus or for congressional committees. Other political scientists may analyze the operations of government agencies or specialize in foreign affairs research, either for government or nongovernment organizations. Others engage in administrative or managerial duties. Some work as legislative aids to congressmen and as staff members of congressional committees.

Places of Employment

About 11,000 political scientists were employed in 1970, largely in colleges and universities or in government agencies. Most of the remainder worked in research bureaus, civic and taxpayers' associations, and large business firms.

Political scientists are employed in nearly every college in the United States, since courses in political science or government are taught widely. Most other political scientists are located in Washington, D.C., in other large cities, or in State capitals. Some, however, are employed in overseas jobs, mainly by the U.S. Department of State, particularly for positions with the Foreign Service, the U.S. Agency for International Development, and the U.S. Information Agency.

Training and Other Qualifications

Graduate training generally is required for employment as a political scientist. College graduates having a master's degree can qualify for various administrative and research positions in government and in nonprofit research or civic organizations. Nearly 100 colleges and universities offer graduate degrees in political science; over 50, in public administration. Many provide field training and offer internships for experience in government work. Many universities award graduate degrees in international relations, foreign service, and area studies, as well as political science in general. A master's degree in any of these fields is very helpful in obtaining a position in a Federal Government agency concerned with foreign affairs.

Completion of all requirements for the Ph. D. degree, except the doctoral dissertation, is the usual prerequisite for appointment as a college instructor. The Ph. D. degree itself usually is required for advancement to the position of professor.

Some young persons having only a bachelor's degree in political science may qualify as trainees in public relations or research work, or in jobs such as budget analyst, personnel assistant, or investigators in government or industry. Many students having the bachelor's degree in political science go on to study law; others obtain graduate training in public administration, international relations, or some other specialized branch of political science.

Young persons planning careers as political scientists should be prepared for a life of reading, study, and research. An increasing reliance upon mathematical and statistical methods in some specialties within the field make some knowledge of these disciplines useful. As with all social sciences, political scientists must be willing to work with ideas and theories, and able to originate and to express themselves clearly in writing and speaking. The ability to work independently also is important.

Employment Outlook

Employment of political scientists is expected to increase rapidly through the 1970's. The greatest increase in employment will take place in colleges and universities. In government agencies also, the number of political scientists in administrative jobs will probably rise because of a growing recognition of the value of specialized training in developing and planning new programs and analyzing policy alternatives. Government agencies concerned with foreign affairs will continue to employ many political scientists. In private industry, on the other hand, a slow growth is anticipated in employment of political scientists. In addition to those required to staff new positions, many political scientists will be needed to fill positions vacated because of retirements, deaths, or transfers.

Employment opportunities will be more limited for those having less than the Ph. D. degree, but openings will be available to them in Federal, State, and municipal government agencies; research bureaus; political organizations; and civic and welfare agencies. For new graduates having only the bachelor's degree, opportunities for employment in the political science field probably will continue to be very limited. However, those planning to continue their studies in law, foreign affairs, journalism, and other related fields will find their political science background very helpful. Some who meet State certification requirements will be able to enter high school teaching.

Earnings

In educational institutions the average beginning salary of political scientists having the master's degree was $6,000 to $8,500 in 1970, according to a recent survey. The National Science Foundation reports that the median salary for all those in educational institutions was $12,000 for the academic year and $15,300 for the calendar year.

In the Federal Government, the starting salary for political scientists having a bachelor's degree was about $6,500 a year in 1970. Those having a superior academic record or a year of graduate training were eligible for positions at an annual salary of about $8,100. Most of the experienced political scientists in the Federal Government earned considerably more.

Some political scientists, particularly those in college teaching, supplement their income by doing summer teaching or consulting work.

Sources of Additional Information

Additional information on employment opportunities in political science and public administration may be obtained from the following organization:

American Political Science Association, 1527 New Hampshire Ave. NW., Washington, D.C. 20036.

SOCIOLOGISTS

(D.O.T. 054.088)

Nature of the Work

Sociologists study the groups which man forms in his association with others—families, tribes, communities, and States, and a great variety of social, religious, political, business, and other organizations. They study the behavior and interaction of these groups, trace their origin and growth, and analyze the influence of group activities on individual members.

Some sociologists are concerned primarily with the characteristics of the social groups and institutions themselves; others are more interested in the ways individuals are affected by groups to which they belong.

Many work in specialties such as social organization, social psychology, or rural sociology; others specialize in intergroup relations, family problems, social effects of urban living, population studies, or analyses of public opinion. Some conduct surveys or concentrate on research methods. Growing numbers apply sociological knowledge and methods in penology and correction, education, public relations in industry, and regional and community planning. A few specialize in medical sociology—the study of social factors that affect mental and public health.

Most sociologists are college teachers, but, as a rule, these teachers also conduct research. Sociological research often involves the collection of data, preparation of case studies, testing, and the conduct of statistical surveys and laboratory experiments.

In their research work, sociologists may study individuals, families, or communities in an attempt to discover the causes of social problems—such as crime, juvenile delinquency, or poverty; the normal pattern of family relations; or the different patterns of living in communities of varying types and sizes. They may collect and analyze data from official government sources to illustrate population trends, including changes in age, sex, race, and other population characteristics; and also the extent of population movement among rural, suburban, and urban areas and among different geographic areas.

Sociologists may conduct surveys which add to basic sociological knowledge or which may be used in public opinion, marketing, and advertising research. Some specialize in the use of mass communication facilities, including radio, television, newspapers, magazines, and circulars.

Sociologists sometimes supervise research projects or the operation of social agencies, including family and marriage clinics. Others are consultants and advise on such diverse problems as the management of hospitals for the mentally ill, the rehabilitation of juvenile delinquents, or the development of effective advertising programs to promote public interest in particular products.

Places of Employment

Approximately 12,000 persons were employed as sociologists in 1970. Numerous others were employed in positions requiring some training in this field, including many in social, recreation, and public health work.

About three-fourths of all sociologists are employed in colleges and universities. The remainder work in Federal, State, local, or international government agencies, in private industry, in welfare or other nonprofit organizations, or are self-employed.

Since sociology is taught in most institutions of higher learning, sociologists may be found in nearly all college communities. They are most heavily concentrated, however, in large colleges and universities which offer graduate training in sociology and opportunities for research.

Training, Other Qualifications, and Advancement

A master's degree with a major in sociology usually is the minimum requirement for employment as a sociologist. The Ph. D. degree is essential for attaining a professorship in most colleges or universities, and is commonly required for directors of major research projects, important administrative positions, or consultants.

Sociologists with master's degrees may qualify for many administrative and research positions, provided they are trained in research methods and statistics. They may be responsible for specific portions of a survey or for the preparation of analyses and reports under general supervision. As they gain experience, they may advance to supervisory positions in both public and private agencies. Sociologists with the master's degree may qualify for some college instructorships. Most colleges, however, appoint as instructors only people with training beyond the master's level—frequently the completion of all requirements for the Ph. D. degree except the doctoral dissertation. Outstanding graduate students often can get teaching or research assistantships which will provide both financial aid and valuable experience.

Young people with only a bachelor's degree in sociology are not usually recognized by the profession as sociologists, although they may secure jobs as interviewers or as research assistants working under close supervision. Many are employed as caseworkers, counselors, recreation workers, or administrative assistants in public and private welfare agencies. Sociology majors with sufficient training in statistics may obtain positions as beginning statisticians. Those who meet State certification requirements may teach high school.

The choice of a graduate school is very important for people planning to become sociologists. Students interested in research should select schools which emphasize training in research methods and statistics, and provide opportunities to gain practical experience in research work. Professors and chairmen of sociology departments frequently aid in the placement of graduates.

Sociologists may spend much time studying and doing research and must possess the necessary oral and writing skills to communicate the results of their research. Sociologists should have mathematical skills and the ability to work independently.

Employment Outlook

Employment opportunities for sociologists having the Ph. D. are expected to be good during the 1970's. Those having only the master's degree will probably continue to face considerable competition.

Sociologists well trained in research methods and advanced statistics will have the widest choice of jobs. Employment opportunities are expected to be very good for research workers in rural sociology, community development, population analysis, public opinion research, and various branches of medical sociology. Employment opportunities also will increase in other applied fields, such as the study of juvenile delinquency and education. Some openings are anticipated in a relatively new area, the sociology of law.

Growth in employment of sociologists is expected to increase rapidly through the 1970's. Because of expanding enrollments, most new positions will be in college teaching. Some of these openings will result from the growing trend to include sociology courses in the curricula of other professions, such as medicine, law, and education. A substantial rise in the number of sociologists in nonteaching fields is anticipated to cope with social and welfare problems and to implement educational and social legislation to develop human resources. In addition, several hundred openings will occur each year to replace sociologists who die, retire, or leave the field for other reasons.

Earnings

In 1970, the median academic year salary of sociologists in educational institutions was $12,200, according to the National Science Foundation. Sociologists working in nonprofit organizations and industry had average annual salaries of $14,700 and $16,200, respectively.

In the Federal Government, the beginning salary in 1970 for sociologists having a master's degree and a superior academic record was $9,881. Salaries of experienced sociologists in the Federal Government generally ranged between $11,905 and $19,643 a year.

In general, sociologists with the Ph. D. degree earn substantially higher salaries than those with the master's degree. Many sociologists supplement their regular salaries with earnings from other sources, such as summer teaching and consulting work. Sociologists employed by colleges and universities are the most likely to have additional earnings.

Sources of Additional Information

Additional information on sociologists may be obtained from:

The American Sociological Association, 1001 Connecticut Ave., NW., Washington, D.C. 20036.

TEACHING

Teaching is the largest of the professions. About 2.6 million men and women were full-time teachers in the Nation's elementary schools, secondary schools, and colleges and universities in the 1970–71 school year. In addition, thousands taught part time; among them were many scientists, physicians, accountants, members of other professions and graduate students. Similarly, large numbers of craftsmen instructed part time in vocational schools. Many other people taught in adult education and recreation programs.

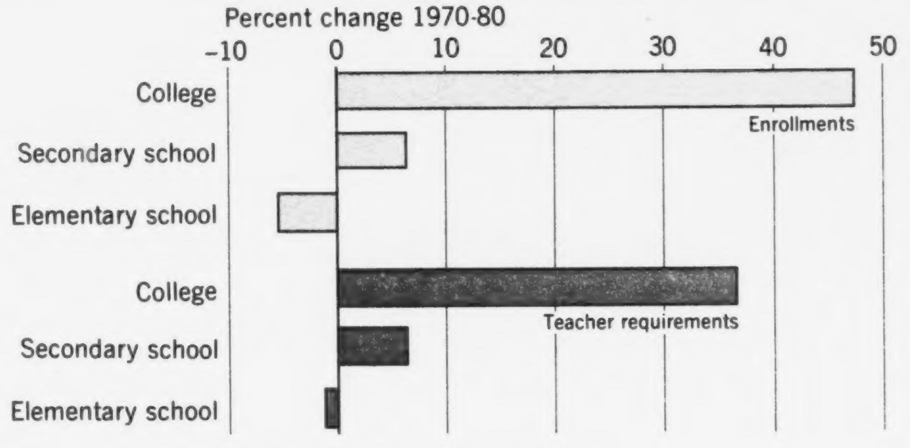
No other profession offers women so many employment opportunities. About 1.7 million or almost 2½ times as many women are teachers as registered nurses, the second largest profession for women. Women teachers far outnumber men in kindergarten and elementary schools and hold more than half the teaching positions in secondary (junior and senior high) schools. However, only about one-fourth of all college and university teachers are women.

The number of teachers needed by the Nation's schools depends chiefly on the number of students enrolled. At the beginning of the 1970–71 school year, 59.2 million people—almost 30 percent of the country's total population—were enrolled in the Nation's schools and colleges. Through the 1970's, continued growth of the school and college population and continued increases in high school and college attendance rates are expected to produce a slight increase in school enrollments and a very rapid rate of increase in college enrollments. Total enrollments in all schools and colleges combined, according to U.S. Office of Education estimates, may exceed 62 million by 1980.

To staff the new classrooms that must be provided for the rising numbers of students, and to continue to improve the student-teacher ratio, the Nation's full-time teaching staff in 1980 will need to be about 7 percent or almost 180,000 more than in 1970. An even larger number of teachers—perhaps as many as 1.8 million—will be required to replace those who leave the profession.

The outlook for teachers at each educational level—in elementary and secondary schools and also in colleges and universities—is discussed in the following statements.

⑰ **Growth in teacher requirements is closely related to student enrollment patterns**



SOURCE: U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE, OFFICE OF EDUCATION

KINDERGARTEN AND ELEMENTARY SCHOOL TEACHERS

(D.O.T. 092.228)

Nature of the Work

Elementary school teaching is the largest field of professional employment for women and is a growing field for men. In the 1970–71 school year, over 1.2 million kindergarten and elementary teachers were employed. In addition, an estimated 60,000 principals and supervisors were working in public and private elementary schools.

Kindergarten teachers conduct a program of education for young children. Most frequently, they teach one group in the morning and another group in the afternoon. Some, however, work with one group all day. They provide the children with experiences in play, music, artwork, stories, and poetry; and introduce them to science, numbers, language, and social studies. In a variety of ways, kindergarten teachers help to develop children's curiosity and zeal for learning, as well as to stimulate their ability to think. After school hours, kindergarten teachers may plan the next day's work, prepare the children's school records, confer with parents or professional personnel concerning individual children, participate in teachers' in-service activities, and locate and become familiar with teaching resources.

Elementary school teachers usually work with one group of pupils during the entire schoolday. They teach several subjects and supervise various activities such as lunch and play periods. In some school systems, however, teachers in the upper elementary grades may teach one or two subjects to several groups of children. Many school systems also employ special teachers to give instruction and to assist classroom teachers in certain subjects such as art, music, physical education, industrial arts, foreign languages, and homemaking. Teachers in schools which have only a few students, largely in rural areas, may be required to teach all subjects in several grades. Programed instruction, including teaching machines and "talking typewriters," and the increasing use of teacher aids are freeing growing numbers of elementary and kindergarten teachers from routine duties and allowing them to give more individual attention to their students.

Places of Employment

Elementary school teachers are employed in all cities, towns, villages, and in rural areas. As a result of reorganization of school districts, many teachers are employed in consolidated schools in small towns.

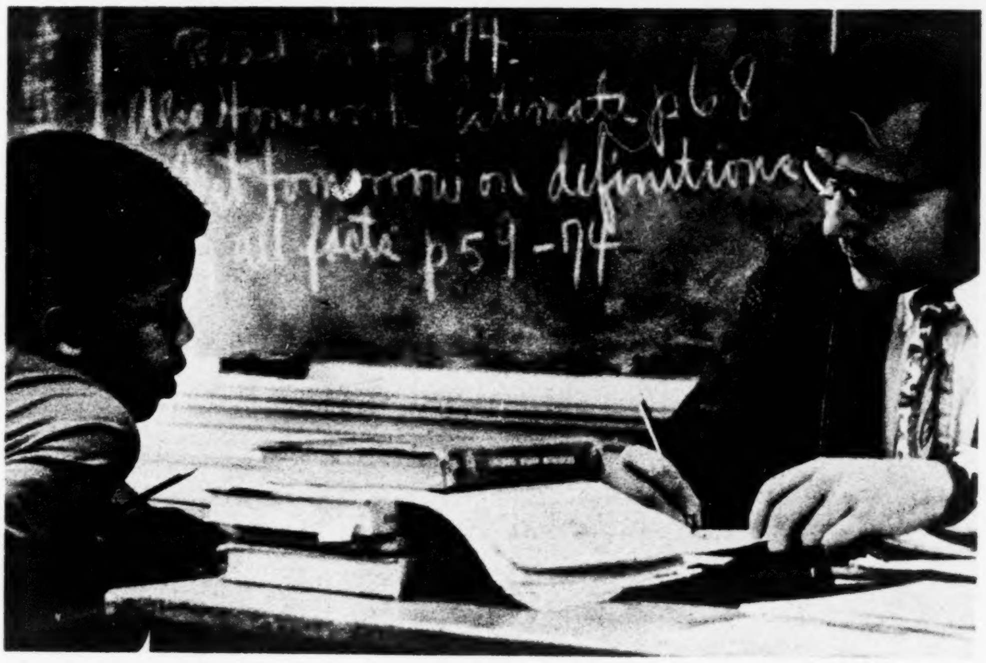
Training, Other Qualifications, and Advancement

All States require that teachers in the public schools have a certificate. Several States require certification for teachers in parochial and other private elementary schools.

In 1970, 47 States and the District of Columbia issued regular teaching certificates only to persons having at least 4 years of approved college preparation. Teacher certification in most States also requires professional education courses. Twelve States require that teachers work toward a fifth year or master's degree within a certain number of years. Some school systems have higher educational requirements than those for State certification.

In nearly all States, certificates are issued by State departments of education on the basis of transcripts of credits and recommendations from approved colleges and universities. Certificates may be issued to teachers from other States if the prescribed programs have been completed at accredited colleges or if the teachers meet the academic and other requirements of the State to which they are applying. Under certain conditions, usually related to a shortage of qualified teachers, most States will issue emergency or temporary certificates to partially prepared teachers. However, these certificates must be renewed annually.

All States have certain additional requirements for public school



teaching. For example, they may require a health certificate, evidence of citizenship, or an oath of allegiance. The prospective teacher should inquire about the specific requirements of the area in which he plans to work by writing to the State department of education or to the superintendent of the local school system.

Most institutions of higher education offer teacher preparation. In a 4-year teacher-preparation curriculum, prospective elementary school teachers spend about one-fourth of the time in professional courses—learning about children, the place of the school in the community, and materials and methods of instruction—including student teaching in an actual school; the remainder of their time is devoted to liberal arts subjects. Some study of human behavior and learning usually is included.

After gaining experience, teachers will find opportunities for advancement through annual salary increases in the same school system; by transferring to a system with a higher salary schedule which recognizes experience gained in another school system; by appointment to a supervisory, administrative, or specialized position in the school system; or by transferring to higher levels of teaching for which their training and experience may qualify them.

Among the most important personal qualifications for elementary school teaching are an enjoyment and understanding of children. Teachers must be patient and self-disciplined, and have high standards of personal conduct. A broad knowledge and appreciation of the arts, sciences, history, and literature also are valuable. Customs and attitudes of the community may influence and sometimes restrict the civic, Social, and recreational activities of teachers.

Employment Outlook

Enrollments in kindergartens and elementary schools in 1980 are expected to be below the 1970 levels. As a result, the number of teaching positions is expected to decline slightly despite an anticipated reduction in the pupil-teacher ratio. Nevertheless, large numbers of teachers will be needed to replace those who retire, die, or leave the profession for other reasons. Also, more than 50,000 teachers will be needed to replace persons not meeting certification requirements. Increasing emphasis on the education of very young children, children in low-income areas, the mentally retarded, and other groups needing special attention may result in larger enrollments and smaller student-teacher ratios than trends would indicate, with an accompanying increase in the number of teachers required.

The number of persons qualified to teach in elementary schools will exceed the number of openings if patterns of entry and reentry to the profession continue in line with past trends. New graduates, therefore, may face keen competition for jobs during the 1970's. Young people seeking their first teaching assignment will find schools placing great emphasis on their academic work and the quality of their training. Nevertheless, employment opportunities may be very favorable in urban ghettos, rural districts, and in all geographic areas where teaching salaries are low and better paying opportunities are available in other fields in the community. The outlook for teachers who are trained to work with children having various handicaps also will be favorable. Many students, however, who are considering elementary teaching as a career will have to change their occupational choice and pursue other careers.

Earnings and Working Conditions

The average salary for classroom teachers in public elementary schools, according to National Education Association (NEA) estimates, was $9,025 in 1970–71. In the five highest paying States (Alaska, New York, California, Michigan, and Hawaii), teachers' salaries averaged $10,000 or more; in the six States having the lowest salaries (Mississippi, South Dakota, Arkansas, North Dakota, South Carolina, and Idaho), they were less than $7,000. An increasing number of States (31 in the 1970–71 academic year) have established minimum salary levels.

Although the average time spent in the classroom (less than 6 hours) usually is less than the average workday in most other occupations, the elementary school teacher must spend additional time each day giving individual help, planning work, preparing instructional materials, developing tests, checking papers, making out reports, and keeping records. Conferences with parents, meetings with school supervisors, and other professional activities also frequently occur after classroom hours.

Since most schools are in session fewer than 12 months a year, teachers often take courses for professional growth or work at other jobs during the summer. Some school systems, however, are extending the teachers' working year to 12 months, including a 1-month vacation in the summer.

Employment in teaching is steady

and usually is not affected by changes in business conditions. Tenure provisions protect teachers from arbitrary dismissal. Pension and sick leave plans are common, and a growing number of school systems grant other types of leave with pay. An increasing number of teachers are being represented by professional teacher associations or by unions that bargain collectively for them on wages, hours, and other conditions of employment.

Sources of Additional Information

Information on schools and certification requirements is available from the State department of education at each State capital.

Information on the Teacher Corps, internships, graduate fellowships, and other information on teaching may be obtained from:

U.S. Department of Health, Education, and Welfare, Office of Education, Washington, D.C. 20202.

Other sources of general information are:

American Federation of Teachers, 1012 14th St. NW., Washington, D.C. 20005.

National Commission on Teacher Education and Professional Standards, National Education Association, 1201 16th St. NW., Washington, D.C. 20036.

SECONDARY SCHOOL TEACHERS

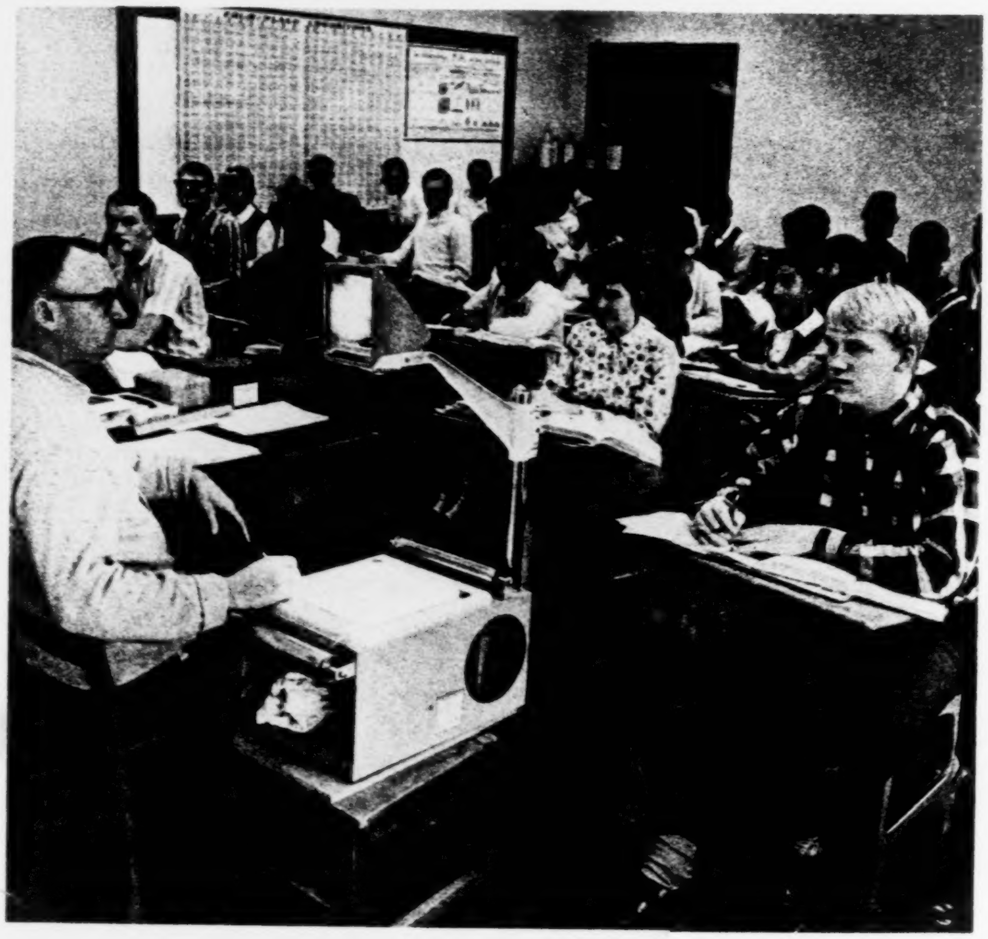
(D.O.T. 091.118 through .228)

Nature of the Work

Secondary school teachers—those employed in junior and senior high schools—usually specialize in a particular subject. They teach several classes every day, either in their main subject, in related subjects, or both. The most frequent combinations are English and history or other social sciences; mathematics and general science; and chemistry and biology or general science. Teachers in some fields, such as home economics, agriculture, commercial subjects, driver education, music, art, and industrial arts, less frequently conduct classes in other subjects. The teaching method may vary from formal lectures to free discussions, depending on the subject and the students' needs and aptitudes. The choice of method usually is left to the teacher.

Besides giving classroom instruction, secondary school teachers plan and develop teaching materials, develop and correct tests, keep records and make out reports, consult with parents, supervise study halls, and perform other duties. The growing use of teaching machines, programmed instruction, and teacher aids relieves the teacher of many routine tasks. Many teachers supervise student activities, such as clubs and social affairs—sometimes after regular school hours. Maintaining good relations with parents and the community is an important aspect of their jobs.

More than 1 million teachers were employed in the Nation's public and private secondary schools in 1970–71. Almost half the classroom teachers in public secondary schools were men. Men far outnumber women as supervisors and administrators in both public and private schools.



Places of Employment

The number of grades in secondary schools depends on the way the local school system is organized. Many secondary school teachers are employed in 6-year combined junior-senior high schools (grades 7–12); others are in separate junior high schools of either two or three grades (7–8 or 7–9); and the remainder teach in 4-year high schools (grades 9–12) and in senior high schools (grades 10–12).

Training, Other Qualifications, and Advancement

In every State, a certificate is required for public secondary school teaching. To qualify for this certificate, the prospective teacher must have at least the equivalent of one-half year of education courses, including practice teaching, plus professional courses in one or more subjects commonly taught in secondary schools.

Twelve States require a fifth year of study or qualification for a master's degree within a specified period following the teacher's beginning employment. Many school systems, especially in large cities, have requirements beyond those needed for State certification. Some systems require additional educational preparation, successful teaching experience, or special personal qualifications.

College students preparing for secondary school teaching usually devote about one-third of the 4-year course to their major, which may be in a single subject or a group of related subjects. About one-sixth of the time is spent in education courses —learning about children, the place of the school in the community, and materials and methods of instruction—including student teaching in an actual school situation. The remaining time is devoted to general or liberal arts courses. Accepted teacher-preparation curriculums are offered by universities with schools of education, by colleges with strong education departments and adequate practice-teaching facilities, and by teachers' colleges.

Although certification requirements vary among the States, the person who is well prepared for secondary school teaching in one State usually has little trouble meeting requirements in another State. A well-qualified teacher ordinarily can obtain temporary certification in a State while preparing to meet its additional requirements.

Qualified secondary school teachers may advance to department heads, supervisors, assistant principals, principals, superintendents, or other administrative officers as openings occur. At least 1 year of professional education beyond the bachelor's degree and several years of successful classroom teaching are required for most supervisory and administrative positions. Often, a doctorate is required for appointment as superintendent. Some experienced teachers are assigned as part- or full-time guidance counselors or as teachers of handicapped or other special groups of children. Usually, additional preparation and sometimes special certificates are required for these assignments.

Probably the most important personal qualifications for secondary school teaching are an appreciation and understanding of adolescent children. Patience and self-discipline are desirable traits, as are high standards of personal conduct. In addition to an enthusiasm for the subjects they teach, a broad knowledge and appreciation of the arts, sciences, history, and literature also are desirable. Civic, social, and recreational activities of teachers may be influenced, and sometimes restricted, by the customs and attitudes of their community.

Employment Outlook

A slowing of enrollment growth in secondary schools is expected during the 1970's. Most teaching positions will result, therefore, from the need to replace the large number of women teachers who leave the profession for family responsibilities. If the total number of degrees awarded increases as projected by the U.S. Office of Education, and if trends in the proportion of graduates prepared to teach in secondary schools continues through the 1970's, the total number of new graduates available for secondary school teaching positions will increase significantly. In addition, many women will continue to wish to reenter teaching after a period of full-time homemaking. New graduates, therefore, may face keen competition for jobs. Also, young people planning to teach, therefore, are likely to find school boards placing much greater emphasis on the type and quality of an applicant's professional training and academic performance.

Despite the anticipated improved supply situation, opportunities will be very favorable in some geographic areas and in subject fields such as the physical sciences, for which the demand in private industry and government is also great. In addition, increased demand for teachers trained in the education of children who are mentally retarded or physically handicapped are expected. Considerable additional demand for teachers also may be generated by Federal legislation that provides for supplementary educational centers and services and the Teacher Corps. These extensive additions to present teaching services will be available to both public and private school children. Nevertheless, if patterns of entry and reentry to the profession continue in line with past trends, the number of persons seeking to enter secondary teaching will significantly exceed requirements. Many students, therefore, who are considering secondary teaching as a career, will have to change their occupational choice and pursue other careers.

Earnings and Working Conditions

The average annual salary for all classroom teachers in public secondary schools was about $9,540 in 1970–71, according to estimates by the National Education Association. In Alaska, California, and New York, average salaries were $11,400 or more. The average was $7,500 or less in Mississippi, Arkansas, Idaho, South Carolina, Kentucky, Alabama, and Oklahoma. At the beginning of the 1970–71 academic year, 31 States had minimum teacher salary laws.

Teachers of vocational education, physical education, and other special subjects often receive higher salaries than other teachers. Under salary schedules in effect in most school systems, teachers in all subject fields get regular salary increases as they gain experience and additional education.

Teachers' salaries usually are lower in towns and small cities than in larger cities or suburbs, but higher educational and experience requirements are likely to prevail in large city school systems. On the average, salaries of principals in the largest cities, where administrative responsibilities are great, are much higher than in towns and small cities. Salaries of superintendents in 1970–71 averaged nearly $40,000 in the largest school systems.

Teachers often add to their incomes by teaching in summer school, working as camp and recreational counselors, or doing other work. Some teachers supplement their incomes during the regular school year. They may teach in adult or evening classes, work part-time in business or industry, or write for publication.

Some form of retirement is provided for most teachers. Nearly all school systems have some provision for sick leave, and an increasing number grant other types of leave with pay.

According to a recent survey, the average workweek of secondary school teachers is about 46 hours a week, of which 23½ hours are spent in classroom instruction and the remainder in out-of-class instruction and other duties. An increasing number of teachers are represented by professional teacher associations or by unions that bargain collectively for them on wages, hours, and other conditions of employment.

Sources of Additional Information

Information on schools and certification requirements is available from the State department of education at the State capital.

Information on the Teacher Corps, internships, graduate fellowships, and other information on teaching may be obtained from:

U.S. Department of Health, Education, and Welfare, Office of Education, Washington, D.C. 20202.

Other sources of information are:

American Federation of Teachers, 1012 14th St. NW., Washington, D.C. 20005.

National Commission on Teacher Education and Professional Standards, National Education Association, 1201 16th St. NW., Washington, D.C. 20036.

COLLEGE AND UNIVERSITY TEACHERS

(D.O.T. 090.168 and .228)

Nature of the Work

About 720,000 teachers were employed in the Nation's 2,600 colleges and universities in the fall of 1970. Approximately 336,000 were full-time teachers of degree credit courses; in addition, 167,000 taught such courses part time. The remainder included junior instructional staff (primarily graduate students), and staff who taught non-degree courses and gave instruction by television, radio, or mail.

Most full-time college and university teachers instruct in the social sciences, teacher education, English and journalism, fine arts, mathematics, physical or biological sciences, engineering, or the health professions. Teaching duties may include preparing and delivering lectures, leading class discussions, directing graduate students in teaching freshman courses, preparing tests and instruction materials, counseling and assisting individual students, and checking and grading assignments and tests. Grading sometimes is done by teaching assistants or, for objective tests, by computers. In many 4-year institutions, the usual teaching load is 12 to 15 hours a week. Associate professors and full

professors—who advise graduate students and often engage actively in research—may spend only 6 to 8 hours a week in actual classroom work.

In addition to teaching, many college teachers conduct or direct research, write for publication, or aid in college administration. Some act as consultants to business, industrial, scientific, or government organizations.

Places of Employment

About nine-tenths of all full- and part-time teachers were employed by universities and 4-year colleges in 1970; most of the remainder were in 2-year institutions.

Men predominate in college teaching and hold more than nine-tenths of the positions in engineering, the physical sciences, agriculture, and law. However, most teachers in nursing, home economics, and library science are women.

College teachers are concentrated in the States having the largest college enrollments. In the fall of 1970, resident and extension enrollments exceeded 1.1 million in California and were over 700,000 in New York. Three other States had enrollments of more than 400,000: Illinois, Texas, and Pennsylvania.

Training, Other Qualifications, and Advancement

To qualify for most beginning positions, applicants must have at least the master's degree, and for many, they must have completed all requirements for the doctorate except the dissertation. A number of States require State certification to teach in public 2-year colleges. To obtain such a certificate, the master's degree and certain courses in education are required.

To enter college teaching, specialization in some subject field is necessary. In addition, undergraduate courses in the humanities, social sciences, natural sciences, and the mastery of at least one foreign language are important. Intensive instruction in the selected field of specialization is given in graduate school. Outstanding graduate students receive valuable experience through part-time teaching assistantships. Some students develop teaching competence by participating in informal seminars or meetings on teaching methods. Some prospective college teachers, especially those in education departments and junior colleges, gain experience in high school teaching.

Most 4-year colleges and universities recognize four academic ranks: Instructor, assistant professor, associate professor, and full professor. A National Education Association survey indicates that one-quarter of the teaching faculty are professors, nearly one-quarter associate professors, one-third are assistant professors, and almost one-fifth are instructors or lecturers.

Few institutions grant tenure (permanent appointment) to instructors having less than 3 years of service. Advancement to associate professorship generally requires considerable teaching experience and often a doctor's degree. In some institutions, research and publication also may be required. A doctor's degree and 7 or more years of teaching experience usually are necessary to become a full professor. Outstanding achievements, generally through research or publications, hastens advancement.

Beginning teachers in fields that are in strong demand, such as engineering, mathematics, and medicine, sometimes are appointed at higher ranks than other teachers having comparable experience and education. A doctor's degree is required particularly for advancement in the biological sciences, physical sciences, psychology, social sciences, philosophy, and religion; it is least likely to be a requirement in business and commerce, engineering, fine arts, health and physical education, and home economics.

Fellowships are available under the National Defense Education Act to candidates for doctoral degrees who plan careers in college or university teaching. The Education Professions Development Act of 1967 authorizes Federally supported fellowships for master's degree study for those planning to enter or already engaged in teaching at two-year colleges, four-year colleges, and universities.

Employment Outlook

College teaching opportunities are expected to be good for those having doctoral degrees or having completed all requirements for the doctorate except the dissertation. Opportunities also will be favorable for new entrants having the master's degree, particularly in 2-year colleges.

A great increase in college enrollment is in prospect. The number of young people in the 18- to 21-year age group is expected to rise by nearly 2.7 million between 1970 and 1980. At the same time, larger proportions of young people of college age will attend college—owing to rising family income, recent Federal legislation to help needy college students, and greater demand for college-trained personnel. The anticipated increase in the number of community colleges and schools offering evening classes also will permit more young people and adults to attend. If the proportion continues to increase and facilities are available, college enrollments for degree credit will increase from 7.6 million in 1970 to more than 11.2 million in 1980, according to the U.S. Office of Education.

Taking all these factors into account, the Office of Education estimates that the full-time college teaching staff for resident degree credit courses will increase from 336,000 in 1970 to 460,000 in 1980, or by 37 percent.

The supply of new college teachers, which consists largely of students receiving graduate degrees, also is expected to grow. The U.S. Office of Education estimates that the number of doctorates conferred through 1980 will average about 50,000 a year, and the number of master's degrees about 360,000 annually. It is difficult, however, to say how many of these will enter teaching. Industry, government, and nonprofit organizations also offer employment opportunities to persons having graduate degrees, often at higher salaries than colleges. However, a smaller proportion of each year's doctor's degree recipients will be needed to meet the demand for college teachers. As a result, persons may face some competition in obtaining positions of their choice.

Earnings and Working Conditions

The median salary of full-time faculty who were engaged primarily in teaching in 4-year institutions was estimated at $11,745 in 1969–70 (9 mo.), based on National Education Association data. Salaries generally were higher in universities than in colleges, and highest in large universities. Highest median salaries were paid in the Far West and New England. Estimated median salaries by rank were:

Professor	$16,799
Associate Professor	12,985
Assistant Professor	10,698
Instructor or Lecturer	8,416

The median salary paid full-time faculty in public 2-year colleges in 1969–70 was estimated at $10,850. Teachers in nonpublic 2-year colleges received an estimated median salary of $8,190.

Faculty members who teach year round usually receive higher salaries than those employed for the academic year only. Teachers in professional schools (medicine, dentistry, etc.) and graduate schools generally receive higher salaries than teachers in other colleges.

Some faculty members supplement their regular salaries with earnings from a variety of sources. The chief source is additional teaching (often in summer sessions). Consulting work may be a major source of extra income, particularly in engineering and physical sciences. Research grants are now common, especially in many large, well-known universities; fees for lecturing and royalties on publications are other possible sources of income. Opportunities for additional income usually increase as the faculty member gains recognition. For most college teachers, additional income is small.

Retirement plans differ considerably among institutions, but an increasing number are participating in the Government social security program, often as an accompaniment to plans of their own. The greatest number of institutions have set 65 years as the normal retirement age, although most of these extend the age limit if desired.

Many colleges and universities provide benefits such as: Sabbatical leaves of absence—typically, 1 year's leave with half salary or a half-year's leave at full salary after 6 or 7 years of employment; other types of leave for advanced study; life, sickness, and accident insurance; reduced tuition charges or cash-tuition grants for children of faculty members; housing allowances; travel funds for attending professional meetings; and other benefits.

Sources of Additional Information

Information on college teaching as a career is available from:

U.S. Department of Health, Education, and Welfare, Office of Education, Washington, D.C. 20202.

American Association of University Professors, 1 Dupont Circle NW., Washington, D.C. 20036.

American Council on Education, 1 Dupont Circle NW., Washington, D.C. 20036.

American Federation of Teachers, 1012 14th St. NW., Washington, D.C. 20005

National Education Association, 1201 16th St. NW., Washington, D.C. 20036.

Professional societies in the various subject fields will generally provide information on teaching requirements and employment opportunities in their particular fields. Names and addresses of societies are given in the statements on specific professions elsewhere in the *Handbook*.

TECHNICIAN OCCUPATIONS

Technician occupations are growing rapidly because of the needs of an expanding and increasingly technical economy matched to the growing recognition of the importance of technicians. This chapter is concerned with the technicians who work with engineers and scientists, and with draftsmen, also usually considered technicians. Information on surveyors, often classified as technicians, and on technical occupations in the health field—including dental laboratory technicians, radiological technologists, and dental hygienists—is presented elsewhere in the *Handbook*.

ENGINEERING AND SCIENCE TECHNICIANS

(D.O.T. .002 through .029)

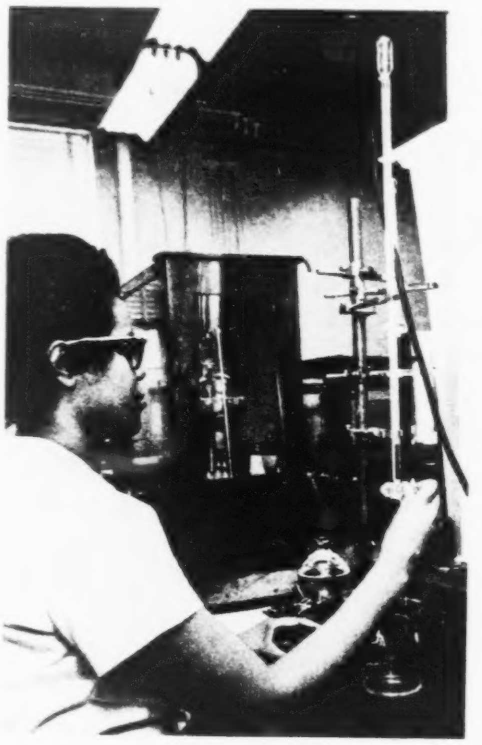
Nature of the Work

The term "technician," as used here, refers to workers whose jobs require both knowledge and use of scientific and mathematical theory; specialized education or training in some aspect of technology or science; and who, as a rule, work directly with scientists and engineers. There is no generally accepted definition of the term "technician." For example, it is used by employers to refer to workers in a great variety of jobs, requiring a wide range of education and training. The term is applied to employees doing relatively routine work, to persons performing work requiring skills within a limited sphere, and to persons doing highly technical work, among them assistants to engineers and scientists.

The workers' job titles may be descriptive of their technical level (for example, biological aid, or engineering technician) or their work activity (for example, quality-control technician, production analyst, tool designer, materials tester, or time-study analyst). Some employees use the word "technician," preceded by adjectives, such as mechanical, electrical, electronics, or chemical, which describes areas of technology in which their personnel are employed.

The jobs of engineering and science technicians are more limited than those of the professional engineer or scientist, and have a greater practical orientation. Many technician jobs require the ability to analyze and solve engineering and science problems and to prepare formal reports on experiments, tests, or other projects. Most of these jobs require some aptitude in mathematics; others, the ability to visualize objects and to make sketches and drawings. Design jobs often require creative ability. Many technician jobs require some familiarity with one or more of the skilled trades, although not the ability to perform as a craftsman. Others demand extensive knowledge of industrial machinery, tools, equipment, and processes. Some jobs held by these technicians are supervisory and require both technical knowledge and the ability to supervise people.

In carrying out their assignments, engineering and science technicians frequently use complex electronic and mechanical instruments, experimental laboratory apparatus, and drafting instruments. Almost all of the technicians whose jobs are described in this statement must be able to use engineering handbooks and computing devices, such as the slide rule or calculating machine.



Technicians engage in virtually every aspect of engineering and scientific work. In research, development, and design, one of the largest areas of employment, they conduct experiments or tests; set up, calibrate, and operate instruments; and make calculations. They also assist scientists and engineers in developing experimental equipment and models by making drawings and sketches and, under the engineer's direction, frequently do some design work.

Technicians also work in jobs related to production, usually following a program course laid out by the engineer or scientist, but often without close supervision. They may aid in the various phases of production operation, such as working out specifications for materials and methods of manufacture, devising tests to insure quality control of products, or making time-and-motion studies (timing and analyzing the worker's movements) designed to improve the efficiency of a particular operation. They also may perform liaison work between engineering and production or other departments.

Technicians often do work that might otherwise have to be done by engineers. They may serve as technical sales or field representatives of manufacturers; advise on installation and maintenance problems of complex machinery; or write specifications and technical manuals. (See statement on Technical Writers.)

The following sections describe a number of technological fields in which engineering and science technicians are trained and employed.

Aeronautical Technology. Technicians specializing in this area of technology work with engineers and scientists in many phases of the design and production of aircraft, helicopters, rockets, guided missiles, and spacecraft. Many aid engineers in preparing layouts of structures, control systems, or equipment installations by collecting information, making calculations, and performing many other tasks. They work on projects involving stress analysis, aerodynamics, structural design, flight test evaluation, or weight control. For example, under the direction of an engineer, a technician might estimate weight factors, centers of gravity, and other items affecting load capacity of an airplane or missile. Other technicians working on engineering projects prepare or check drawings for technical accuracy, practicability, and economy.

Technicians sometimes help to estimate the cost of the materials and labor needed to manufacture aircraft and missiles. They also may be responsible for liaison between the engineers who do the planning and development work, and the craftsmen who convert the engineers' ideas into finished products. For example, as an aircraft or missile is built, the liaison technician checks it for conformance to specifications, keeps the engineer informed as to progress, and investigates any production engineering problems that arise. He sometimes recommends minor changes in the design, the materials, or the method of fabrication.

Other aeronautical technicians are employed as manufacturer's field service representatives, serving as the link between their company and the military, commercial airlines, and other customers. Technicians often prepare instruction manuals, bulletins, catalogs, and other technical materials. (See statements on Aerospace Engineers and Airplane Mechanics, and chapter on Occupations in Aircraft, Missile, and Spacecraft Manufacturing.)

Air-Conditioning, Heating, and Refrigeration Technology. Air-conditioning technology involves the control of air including its heating, cooling, humidity, cleanliness, and movement. Technicians in this field often become specialists in one area of work, such as refrigeration, and sometimes in a particular type of activity, such as research and development or design of layouts for heating, cooling, or refrigeration systems.

In the manufacture of air-conditioning, heating, and refrigeration equipment, technicians work in research and engineering departments, usually as aids to engineers and scientists. They may be assigned to such jobs as devising methods for testing equipment or analyzing production methods. Technically trained personnel also assist in designing the air-conditioning, heating, or refrigeration systems for a particular office, store, or other location and prepare instructions for their installation. In designing the layout for an air-conditioning or heating system, they must determine the cooling or heating requirements, decide what kind of equipment is most suitable, and estimate costs. Technicians employed as salesmen by equipment manufacturers must be able to supply contractors who design and install systems with information on such technical subjects as installation, maintenance, operating costs, and expected performance of equipment. (See also statement on Refrigeration and Air-Conditioning Mechanics.)

Chemical Technology. Technicians specializing in this area work mainly with chemists and chemical engineers in the development, production, sale, and utilization of chemical and related products and equipment. The field of chemistry is so broad that chemical technicians often become specialists in the problems of a particular industry, such as food processing, or in a particular activity, such as quality control.

Most chemical technicians work in research and development, testing, or other laboratory work. They conduct experiments and tabulate and analyze the results. In testing work, technicians make chemical tests of materials to determine whether the materials meet specifications or whether particular substances are present and, if so, in what quantities. They may, for example, analyze steel for carbon, phosphorous, and sulfur content, or water for the amount of silica, iron, and calcium present. They also perform experiments to determine the characteristics of substances such as the specific gravity and ash content of oil. Technicians employed in research or testing laboratories often assemble and use such apparatus and instruments as dilatometers (which measure the dilation or expansion of a substance), analytical balances, and centrifuges.

Outside the laboratory, chemical technicians are sometimes employed to supervise various operations in the production of chemical products and as technical salesman of chemicals and chemical equipment. (See also statements on Chemists and Chemical Engineers, and chapter on Occupations in the Industrial Chemical Industry.)

Civil Engineering Technology. Technicians trained in this area assist civil engineers in performing many of the tasks necessary in the planning, design, and construction of highways, railroads, bridges, viaducts, dams, and other types of structures. During the planning stage, technicians may help to estimate costs, to prepare specifications for materials, or participate in surveying, drafting, detailing, or designing work. Once the actual construction work has begun, they may assist the contractor or superintendent in scheduling construction activities or inspecting the work to assure conformance to blueprints and specifications. (See also statements on Civil Engineers, Draftsmen, and Surveyors.)

Electronics Technology. This field includes radio, radar, sonar, telemetering, television, telephony, and other forms of communication; industrial and medical measuring, recording, indicating, and controlling devices; navigational equipment; missile and spacecraft guidance and control instruments; electronic computers; and many other types of equipment using vacuum tubes, transistors, semiconductors, and printed circuits. Because the field is so broad, technicians generally become specialists in one area—for example, induction or dielectric heating, servomechanisms, automation controls, or ultrasonics.

Technicians working with engineers and scientists in the field of electronics do complex technical work that is more difficult than routine operating and repair work. (For additional information on broadcast technicians see chapter on Occupations in Radio and Television Broadcasting.)

Industrial Production Technology. Technicians trained in this area are sometimes called *industrial technicians or production technicians.* They assist industrial engineers on problems involving the efficient use of personnel, materials, and machines in the production of goods or services. Their work includes preparing layouts of machinery and equipment, planning the flow of work, and making statistical studies and analyses of production costs. The industrial technician also may conduct time-and-motion studies.

In the course of their duties, many industrial technicians acquire experience which enables them to qualify for other jobs. For example, those expert in machinery and production methods may move into the field of industrial safety. Others who specialize in job analysis may become involved in the setting of job standards and in the interviewing, testing, hiring, and training of personnel. Still others may move into production supervision. (See statements on Personnel Workers and Industrial Engineers.)

Mechanical Technology. Mechanical technology is a broad term usually used to cover a large number of specialized fields, including automotive technology, diesel technology, tool design, machine design, and production technology.

Technicians in the above areas of mechanical technology often assist engineers in design and development work by making freehand sketches and rough layouts of proposed machinery and other equipment and parts. They help to determine whether a proposed design change in a product is practical and how much the product will cost to produce. They also may be required to solve design problems such as those involving tolerance, stress, strain, friction, and vibration.

The planning and testing of experimental machines and equipment for performance, durability, and efficiency provide a large area of work for technicians. In the testing procedure, they record data, make computations, plot graphs, analyze results, and write reports. They sometimes make recommendations for design changes to improve performance. Their jobs often require skill in the use of instruments, test equipment and gages, such as dynamometers, as well as the ability to prepare and interpret drawings.

One of the better known specialties which may be grouped under mechanical engineering technology is that of *tool designer*. The tool designer designs tools and devices for the mass production of manufactured articles. He originates and prepares sketches of the designs for cutting tools, jigs, dies, special fixtures, and other attachments used in machine operations. He also may make detailed drawings of these tools and fixtures or supervise others in making them. Besides developing new tools, designers frequently redesign tools to improve their efficiency.

Machine drafting, with some designing, is another major area of work often grouped under mechanical technology. The work is described elsewhere in this chapter.

Some mechanical technicians are employed in manufacturing departments to help develop plans for testing and inspecting machines and equipment, or to work with engineers in eliminating production problems. Some obtain jobs as technical salesmen. (See statements on Mechanical Engineers, Automobile Mechanics, Manufacturers' Salesmen, and Diesel Mechanics.)

As industry becomes increasingly mechanized, new technical occupations continue to emerge. For example, *instrumentation technology* has evolved from the introduction of automatic controls and precision-measuring devices in manufacturing operations. In industrial plants and laboratories, instruments are used to record data, to control and regulate the operation of machinery, and to measure time, weight, temperature, speed of moving parts, mixtures, volume, flow, strain, and pressure. Technicians in this field work with engineers and scientists who develop and design these highly complex devices, as well as with those who use them for research and development work. (See also statement on Instrument Makers.)

Another new area of work for technicians, which has resulted from recognition of the need for a more scientific approach toward the reduction of industrial hazards, is safety technology. In the rapidly growing atomic energy field, in particular, technicians work with scientists and engineers on problems of radiation safety, inspection, and decontamination. (See chapter on Occupations in the Atomic Energy Field.) Other new areas include the environmental control field, where technicians are concerned with the problems of air and water pollution.

Places of Employment

An estimated 650,000 engineering and science technicians, not including draftsmen and surveyors, were employed in 1970—about 11 percent were women. Nearly 460,000 of these technicians (more than 7 out of 10) were employed by private industry. The manufacturing industries employing the largest numbers of engineering and science technicians were electrical equipment, chemicals, machinery, and aerospace. In the nonmanufacturing sector, large numbers of technicians were employed in the communications industry and by engineering and architectural firms.

In 1970, the Federal Government employed over 85,000 engineering and science technicians; chiefly as engineering aids and technicians, electronic technicians, equipment specialists, cartographic aids, meteorological technicians, and physical science technicians. Of these engineering and science technicians, the largest number worked for the Department of Defense. Most of the others were employed by the Departments of Transportation, Agriculture, Interior, and Commerce.

State Government agencies employed nearly 50,000 engineering and science technicians in 1970 and local governments about 12,000. The remainder were employed by colleges and universities, mostly in university-operated research institutes, and by nonprofit organizations.

Training, Other Qualifications, and Advancement

Young men and women who wish to prepare for careers as engineering or science technicians can obtain the necessary training from a great variety of educational institutions or can qualify for their work right on the job. Most employers, however, seek workers who have had some form of specialized training for more responsible technician jobs. Specialized formal training programs are offered in post-secondary schools—technical institutes, junior and community colleges, area vocational technical schools, and extension divisions of colleges and universities—as well as in technical and technical-vocational high schools. Other ways in which persons can become qualified for technician jobs are by completing an on-the-job training program, through work experience and formal courses taken on a part-time basis in post-secondary or correspondence schools, or through training and experience obtained while serving in the Armed Forces. In addition, many engineering and science students who have not completed all the requirements for a bachelor's degree, as well as some other persons having a college education in mathematics and science, are able to qualify for technician jobs after they obtain some additional technical training and experience. In general, post-secondary school technical training is required for a growing number of engineering and science technician jobs.

Engineering and science technicians usually begin work as trainees or in the more routine positions under the direct supervision of an experienced technician, scientist, or engineer. As they gain experience, they are given more responsibility, often carrying out a particular assignment under only general supervision. Technicians may move into supervisory positions. Those having exceptional ability sometimes obtain additional formal education and are promoted to professional engineering positions.

For admittance to most schools offering post-secondary technician training, a high school diploma is usually required. Some schools, however, admit students without a high school diploma if they are able to pass special examinations and otherwise demonstrate their ability to perform work above the high school level. All engineering and science occupations require basic training in mathematics and science, thus students should obtain a sound background in these subjects when in high school. Many post-secondary schools have arrangements for helping students make up deficiencies in these subjects.

Programs offered by schools specializing in post-secondary technical training require 1, 2, 3, or 4 years of full-time study. The majority are 2-year programs leading to an associate of arts or science degree. Evening as well as day sessions are generally available. The courses offered in science, mathematics, and engineering are usually at the college level. They include instruction in laboratory techniques and the use of instruments, and emphasize the practical problems met on the job. Students also are instructed in the use of machinery and tools to give them a familiarity with this equipment rather than to develop skills.

Some 4-year programs for the bachelor's degree in technology place more emphasis on courses in the humanities and business administration than the 2-year programs, while other 4-year programs emphasize additional technical training.

Because of the variety of educational institutions and the differences in the kind and level of education and training, persons seeking a technical education should use more than ordinary care in selecting a school. Information should be secured about the fields of technology in which training is offered, accreditation, the length of time the school has been in operation, instructional facilities, faculty qualifications, transferability of credits toward the bachelor's degree, and the type of work obtained by the school's graduates.

Briefly discussed here are some of the types of post-secondary educational institutions and other sources where young people can obtain training as technicians.

Technical Institutes. Technical institutes offer training designed to qualify the graduate for a specific job or cluster of jobs immediately upon graduation with only a minimum of on-the-job training. In general, the student receives intensive technical training but less theoretical and general education than is provided in curriculums leading to a bachelor's degree in engineering and liberal arts colleges. A few technical institutes and community colleges offer cooperative programs in which a student spends part of his time in school and part in paid employment related to the occupation for which he is preparing himself.

Some technical institutes are operated as regular or extension divisions of colleges and universities. Others are separate institutions operated by States or municipalities, privately endowed institutions, and proprietary schools.

Junior Colleges and Community Colleges. Many junior and community colleges offer the necessary training to prepare students for technician occupations. Some of these schools offer curriculums that are similar to those given in the freshman and sophomore years of 4-year colleges. Graduates can transfer after the junior college into a 4-year college or qualify for some technician jobs. Most large community colleges offer 2-year technical programs, and many employers express a preference for graduates having this more specialized training. Junior college courses in technical fields are often planned around the employment needs of the industries in their locality.

Area Vocational-Technical Schools. Area vocational-technical schools are post-secondary public institutions that are established in central locations to serve students from several surrounding areas. In general, the admission requirements of vocational-technical schools are as rigid as those of other schools offering post-secondary technician training. Area school curriculums are usually designed to train the types of technicians most needed in the area.

Other Training. Some large corporations conduct training programs to meet their need for technically trained personnel. This type of training is primarily technical and rarely includes any general studies.

Training for some occupations in the technician category—tool designer and electronic technican, for example—may be obtained through a formal apprenticeship.

Some training also is available in special purpose institutions that specialize in a single field, such as electronics.

Correspondence schools also provide technician training for those who wish to learn more about their jobs.

Technician training is offered by all branches of the Armed Forces. Many of the technicians trained by the military utilize their training in civilian employment, especially in the field of electronics, after they leave the Armed Forces.

Employment Outlook

Employment opportunities for engineering and science technicians are expected to be very good through the 1970's. The demand will be strongest for graduates of post-secondary school technician training programs.

Among the factors underlying the increase in demand for technicians are the anticipated expansion of industry and the increasing complexity of modern technology. As products and the methods by which they are manufactured become more complex, more technicians will probably be required to assist engineers. They may be needed in such activities as production planning, and maintaining liaison between production and engineering departments, and in technical sales work. Furthermore, as the employment of scientists and engineers continues to grow, increasing numbers of technicians will be needed to assist them. The trend toward automation of industrial processes will probably also add to the demand for technical personnel; so will the growth of new areas of work, such as those related to space and oceanographic exploration, atomic engery, environmental control, or urban development. In addition to the technicians needed to fill new positions, thousands will be needed each year through the 1970's to replace those who retire, die, or transfer to other occupations.

Another factor supporting the expected increase in demand for engineering and science technicians is the growth anticipated in research and development (R&D) expenditures. During the 1970 decade, R&D expenditures of Government and industry are expected to increase, although at a slower rate than during the 1960's. The anticipated slowdown in Federal R&D spending basically reflects anticipated reductions in the relative importance of the space and defense components of R&D expenditures. These trends were evidenced in the late 1960's and in 1970.

Expenditures for defense and space programs also affect the demand for technical personnel, because a large number are engaged in activities related to the defense and space programs. The above outlook for technicians is based on the assumption that defense activity as measured by expenditures will be somewhat higher than the level before the Vietnam buildup, approximating the level of the early 1960's. If defense activity should differ substantially from that level, the demand for technicians would be affected accordingly.

Well-qualified women technicians should continue to find favorable employment opportunities, chiefly in designing jobs, in chemical and other laboratory work, and in computation and other work requiring the application of mathematics. Over the long run, it is likely that more women will be trained and will find employment in these and other technician occupations.

Earnings

In general, a technician's earnings depend upon his education and technical specialty, as well as his ability and work experience. Other important factors which influence his earnings are the type of firm for which he works, his specific duties, and the geographic location of his job.

In Federal Government agencies in 1970, beginning engineering and science technicians were offered $5,212, $5,853 or $6,548, depending upon the type of job vacancy and the applicant's education and other qualifications. Some Federal Government agencies hire high school graduates and train them for technician jobs. Beginning salaries for these jobs were $4,621 a year.

Starting salaries in private industry in 1970, for technicians holding associate degrees, ranged from about $6,500 to $8,300 a year; the average was about $7,400.

Most technicians can look forward to an increase in earnings as they move to higher positions. In 1970 annual salaries of workers in responsible technician positions in private industry averaged almost $11,000 and approximately one-fourth of the workers had annual salaries above $11,900, according to a Bureau of Labor Statistics survey.

Sources of Additional Information

General information on careers for engineering and science technicians may be obtained from:

American Society for Engineering Education, Suite 400, 1 Dupont Circle, Washington, D.C. 20036.

Engineers' Council for Professional Development, 345 East 47th St., New York, N.Y. 10017.

National Council of Technical Schools, 1835 K. Street, NW., Room 907, Washington, D.C. 20006.

Information on training opportunities may also be obtained from the Engineers' Council for Professional Development, a nationally recognized accrediting agency for engineering technology programs; the National Council of Technical Schools; and the U.S. Department of Health, Education, and Welfare, Office of Education, Division of Higher Education and/or Division of Vocational and Technical Education, Washington, D.C. 20202.

State departments of education at each State capital also have information about approved technical institutes, junior colleges, and other educational institutions within the State offering post-high school training for specific technical occupations. Other sources include:

American Association of Junior Colleges, Suite 410, 1 Dupont Circle, Washington, D.C. 20036.

National Home Study Council, 1601 18th St. NW., Washington, D.C. 20009.

DRAFTSMEN

(D.O.T. 001. through 019.)

Nature of the Work

In making a space capsule or an electric iron, a nuclear submarine or a television set, a bridge or a typewriter, detailed drawings are needed that give the exact physical dimensions and specifications of the entire object and each of its parts. The workers who draw these plans are draftsmen.

Draftsmen translate the ideas, rough sketches, specifications, and calculations of engineers, architects, and designers into working plans which are used in making a product. Draftsmen may calculate the strength, reliability, and cost of materials. In their drawings and specifications, they describe exactly what materials and workers are to use on a particular job. To prepare their drawings, draftsmen use instruments such as compasses, dividers, protractors, templates and triangles, as well as machines that combine the functions of several devices. They also may use engineering handbooks, tables, and slide rules to assist in solving technical problems.

Draftsmen are often classified according to the type of work they do or their level of responsibility. *Senior draftsmen* use the preliminary information provided by engineers and architects to prepare design "layouts" (drawings made to scale of the object to be built). *Detailers* make drawings of each part shown on the layout, giving dimensions, material, and any other information necessary to make the detailed drawing clear and complete. *Checkers* carefully examine drawings for errors in computing or in recording dimensions and specifications. Under the supervision of draftsmen, *tracers* make minor corrections and prepare drawings for reproduction by tracing them on transparent cloth, paper, or plastic film.

Draftsmen also may specialize in a particular field of work, such as mechanical, electrical, electronic, aeronautical, structural, or architectural drafting.

Places of Employment

An estimated 310,000 draftsmen were employed in 1970; almost 4 percent were women. About 9 out of 10 draftsmen are employed in

private industry. Manufacturing industries that employ large numbers are those making machinery, electrical equipment, transportation equipment and fabricated metal products. Nonmanufacturing industries employing large numbers are engineering and architectural consulting firms, construction companies, and public utilities.

Over 20,000 draftsmen worked for Federal, State, and local governments in 1970. Of those employed by the Federal Government, the large majority worked for the Departments of the Army, Navy, and Air Force. Draftsmen employed by State and local governments worked chiefly for highway and public works departments. Several thousand draftsmen were employed by colleges and universities and by nonprofit organizations.

Training, Other Qualifications, and Advancement

Young persons interested in becoming draftsmen can acquire the necessary training from a number of sources, including technical institutes, junior and community colleges, extension divisions of universities, vocational and technical high schools, and correspondence schools. Others may qualify for draftsmen jobs through on-the-job training programs combined with part-time schooling or through 3- or 4-year apprenticeship programs.

The prospective draftsman's training, whether obtained in high school or post-high school drafting programs, should include courses in mathematics and physical sciences, as well as in mechanical drawing and drafting. The study of shop practices and the learning of some shop skills also are helpful, since many higher level drafting jobs require knowledge of manufacturing or construction methods. Many technical schools offer courses in structural design, strength of materials, and physical metallurgy.

Young people having only high school drafting training usually start out as tracers. Those having some formal post-high school technical training can often qualify as junior draftsmen. As draftsmen gain skill and experience, they may advance to higher level positions as checkers, detailers, senior draftsmen, or supervisors of other draftsmen. Some may become independent designers. Draftsmen who take courses in engineering and mathematics are sometimes able to transfer to engineering positions.

Qualifications for success as a draftsman may include the ability to visualize objects in three dimensions as well as the ability to do freehand drawing. Although such artistic ability is not generally required, it may be very helpful in some specialized fields.

Drafting work also requires good eyesight (corrected or uncorrected), eye-hand coordination, and manual dexterity.

Employment Outlook

Employment opportunities for draftsmen are expected to be favorable through the 1970's. Prospects will be best for those having post-high school drafting training. Well-qualified high school graduates who have had only high school drafting, however, also will be in demand for some types of jobs.

Employment of draftsmen is expected to rise rapidly as a result of the increasing complex design problems of modern products and processes. In addition, as engineering and scientific occupations continue to grow, more draftsmen will be needed as supporting personnel. On the other hand, photoreproduction of drawings and expanding use of electronic drafting equipment and computers are eliminating some routine tasks done by draftsmen. This development will probably bring about a reduction in the need for some less skilled draftsmen.

In addition to draftsmen needed to fill new positions, many will be required each year to replace those who retire, die, or move into other fields of work.

Earnings

In private industry, persons in beginning drafting positions earned an average of about $470 a month in 1970, according to a Bureau of Labor Statistics survey. As they gain experience, draftsmen may move up to higher level positions with a substantial increase in earnings. For example, the earnings of senior draftsmen averaged about $850 a month. Most earned about $700 per month.

In the Federal Civil Service in 1970, the entrance salary for high school graduates without work experience who were employed in trainee-draftsman positions was about $380 a month. For those having post-high school education or some experience in drafting, entrance salaries were higher. The majority of experienced draftsmen working for the Federal Government earned between $600 and $740 a month.

Sources of Additional Information

General information on careers for draftsmen may be obtained from:

American Institute for Design and Drafting, Post Office Box 2955, Tulsa, Oklahoma 74101.

American Federation of Technical Engineers, 1126 16th Street, NW., Washington, D.C. 20036.

See also section on Sources of Additional Information in the statement on Engineering and Science Technicians.

FOOD PROCESSING TECHNICIANS

(D.O.T. 022.281, 029.381)

Nature of the Work

In contrast with the past, when most foods were processed in the home, almost all foods we now eat are processed by industrial firms. A small but important group of workers employed by these firms are food processing technicians.

Food processing technicians assist food scientists in research and development, and in the quality assurance laboratories of processing plants. They also serve as assistant supervisory personnel in production related operations such as processing, packaging and sanitary maintenance, and waste disposal.

Titles of operating and laboratory technicians in the food processing industry vary from plant to plant and industry to industry, as do their responsibilities, which often overlap from one area to the other. Food processing technicians may be known as Laboratory or Quality Assurance Technicians, Physical-Science Aide, Plant Facilities Technician, Biological Aide, Laboratory Analyst, and Research and Development Technician.

In research and development, food processing technicians assist food scientists in improving existing food products, creating new food items, and developing and improving processes related to production. Duties may include weighing out ingredients, performing microbiological tests, and conducting chemical analysis. Technicians also set up panels for organoleptic testing (taste, smell, sight). Other duties include gathering and storing samples for testing; operating and maintaining laboratory equipment; and experimenting with new methods for testing products. Technicians often are required to prepare formal reports on experiments, tests, and other projects. They frequently use instruments such as balances, spectrophotometers (to measure color intensity), autoclaves (for sterilizing), microscopes, and cryoscopes (to determine the freezing point of liquids).

In quality assurance laboratories, they conduct bacteriological, chemical, and physical tests on raw ingredients and finished products to ensure conformance with established industry and government standards. They use equipment such as incubators, refractometers (to measure heat), centrifuges (to separate particles of substances), torsion balances, color comparison charts, and pH meters (to determine the degree of acidity). Other duties may include making brand comparison checks, filling sample orders, and checking samples received against product reports or shipping manifests.

In production operations, food processing technicians assist in the supervision of the overall processing of food products. For example, they work closely with fieldmen to insure a steady flow of products from farm to plant; they inspect incoming raw materials to make certain they are suitable for processing and that they are stored under proper temperatures. Technicians recommend measures to improve production methods, equipment performance, and quality of product, and suggest changes in working conditions and use of equipment to increase processing efficiency. Some technicians supervise packaging operations; others are concerned primarily with sanitation in all areas of a food processing plant. They help identify bacterial problems on the line or in the plant, recommend cleaning and sanitizing solutions, and direct cleaning crews.

Places of Employment

An estimated 3,400 food processing technicians were employed in the food processing industry in 1970. Food processing technicians can be found in all major food industries and are employed in most States. The largest number of food technicians are in those States having the heaviest concentration of food processing workers: California, Illinois, Pennsylvania, Texas, Ohio, New Jersey, Wisconsin, Michigan, Iowa, and New York.

Food technicians, in addition to being employed by food processors, may be employed by State and Federal Government food inspection agencies, food brokers, and supermarket chains. Others are in related fields where their specialized training can be utilized, including food packaging companies, food warehousing and transporting companies, and manufacturer of food processing equipment.

Training, Other Qualifications, and Advancement

Young men and women wishing to prepare for a career as a food processing technician can obtain the necessary training from a variety of educational institutions, or can qualify for their work on the job. Most employers, however, prefer workers who have had some form of specialized training for more responsible technician jobs. Specialized formal training programs are offered in post-secondary schools —technical institutes, junior and community colleges, and technical divisions of four-year universities. For admittance to most schools offering post-secondary technician training, a high school diploma is required.

Students wishing to prepare for a career as a food processing technician should take a year each of biology and chemistry, and two years of mathematics (algebra and geometry) while in high school. English and social science courses also are recommended. Some post-secondary schools, however, admit students on the basis of successful work experience in the food industry and on the recommendation of their employer.

Programs offered by schools specializing in post-high school technical training generally require one, two, and in very few cases, three or four years of full-time study. The majority are 2-year programs leading to an associate of applied science degree. The courses offered usually include chemistry, microbiology. mathematics, and specialized courses in food processing, quality control, packaging, plant and environmental sanitation, and technical report writing. Elective courses such as accounting, economics, and English generally are offered by the post-secondary schools.

Curriculums may vary considerably among the schools offering programs in food science technology. Some schools, for example, have programs in food processing technology geared towards an individual food processing industry, such as the dairy industry. Many 2-year schools require work experience in some phase of the industry between the first and second years, and others recommend that their students obtain this kind of practical experience. The school's placement bureau often assists the prospective technician in finding this type of employment. Besides providing practical experience, this aids the student in paying his tuition expenses and frequently leads to full-time positions after graduation.

Persons can qualify for technician jobs by completing on-the-job training programs, or through work experience and formal courses taken on a part-time basis in post-secondary schools. In addition, many students from various science disciplines who have not completed all the requirements for a bachelor's degree are able to qualify for technician jobs after they obtain some additional technical training and experience. In general, post-secondary school technical training is required for a growing number of food processing technician jobs. Laboratory technicians in the dairy industry must meet licensing requirements in most States. These requirements vary, but generally include a written test. Some states require an applicant to demonstrate his capabilities.

Food processing technicians usually begin work as trainees under the direct supervision of an experienced food scientist, and are systematically assigned to jobs throughout the plant. Technicians may begin their careers at a lower level supervisory capacity and—depending on training, ability, and experience—can work up to the mid-management level. Food technicians working in laboratories are assigned more demanding functions as they gain experience and may advance to other positions such as salesman, purchasing agent, or fieldman.

Food processing technicians generally work as part of a team. Because the quality of processed food may affect many people, the food technician must work to exacting standards and be dependable. He is frequently required to make oral or written reports on the results of his work.

Employment Outlook

Employment opportunities for food processing technicians are expected to be favorable through the 1970's. The demand will be strongest for graduates of post-secondary technical training programs.

Among the factors underlying the increase in demand for food processing technicians are the desire for more convenience foods in the home, and the need for these products by food service institutions. Also, the complexity of new food products and their related processes will create a need for more technicians to assist food scientists and management personnel in such areas as production planning, technical sales work, purchasing, packaging, personnel work, and warehouse management. The need for technicians will be especially critical in quality assurance areas as higher quality and safety standards are set and as more technical supervision in processing becomes necessary. Many smaller processing firms, which currently operate without the aid of technicians, are expected to require them in the future. Furthermore, as the employment of food scientists continues to grow, increasing numbers of technicians will be needed to assist them. In addition to the technicians needed to fill new positions, others will be needed each year through the 1970's to replace those who retire, die, or transfer to other occupations.

Earnings

In general, a technician's earnings depend upon his education, ability, and work experience. Other important factors are the type of firm for which he works, his specific duties, and the geographic location of his job. Beginning food processing technicians were offered starting salaries of $7,000 per year in 1970, based on limited data.

Most technicians can look forward to an increase in earnings as they gain experience and advance to higher level positions.

Sources of Additional Information

For further information regarding careers as food processing technicians, students should contact their school counselors for help in locating technical institutes, junior and community colleges, and universities offering programs in food processing technology. (See also section on Sources of Additional Information in the statement on Engineering and Science Technicians.)

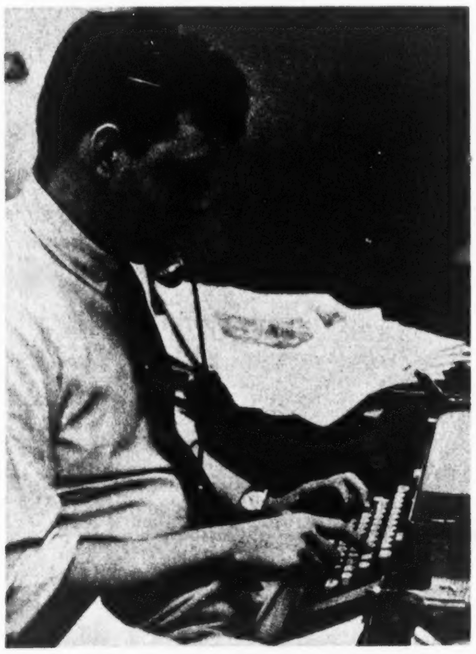
WRITING OCCUPATIONS

NEWSPAPER REPORTERS

(D.O.T. 132.268)

Nature of the Work

Newspaper reporters gather information on current events and use it to write stories for publication in daily or weekly newspapers. In covering events, they may interview people, review public records, attend news happenings, and do research. As a rule, reporters take notes or use electronic recording devices while collecting the facts, and write their stories upon return to the office. Sometimes, to meet deadlines, they telephone their stories to other staff members known as "rewrite men," who write the stories for them.



Large dailies frequently assign some reporters to "beats," such as police stations or the courts, to cover news originating in these places. Other local news, such as a story about a lost child or an obituary of a community leader, is handled by general assignment reporters. Specialized reporters, who are well-versed in a subject-matter field as well as in writing, increasingly are interpreting and analyzing the news in fields such as medicine, politics, science, education, business, labor, and religion. Reporters on small newspapers get broad experience; they not only cover all aspects of local news, but also may take photographs, write headlines, lay out inside pages, and even write editorials. On the smallest weeklies, they also may solicit advertisements, sell subscriptions, and perform general office work.

Places of Employment

An estimated 39,000 newspaper reporters were employed in the United States in 1970; more than 35 percent were women. The majority of reporters work for daily newspapers; others work for weekly papers, press services, and newspaper syndicates.

Reporters work in cities and towns of all sizes throughout the country. Of the 1,760 daily and 9,000 weekly newspapers, the great majority are in medium-size towns. Large numbers of reporters, however, are in cities, since big city dailies employ many reporters, whereas a small-town paper generally employs only a few.

Training, Other Qualifications, and Advancement

Most newspapers will consider only applicants having a college education. Graduate work is increasingly important. Some editors prefer graduates who have a degree in journalism, which usually involves a liberal arts education as well as professional training. Other editors consider a degree in liberal arts equally desirable. Although talented writers having little or no academic training beyond high school sometimes become reporters on city newspapers, most reporters without college training begin—and usually remain—on rural, small-town or suburban papers.

Professional studies leading to a bachelor's degree in journalism can be obtained in nearly 200 colleges; about two-thirds of these have separate departments or schools of journalism. The typical undergraduate journalism curriculum is offered during the junior and senior years of college, and is divided about equally between cultural and professional subjects. Among the professional courses are reporting, copyreading, editing, feature writing, and the history of journalism.

Over 250 junior colleges offer journalism programs. Credit secured in most is transferable to the 4-year college programs in journalism. In addition, some junior colleges offer programs especially designed to prepare the student directly for employment as a general assignment reporter on weekly and small daily newspapers.

The master's degree in journalism is awarded by 52 schools; 20 of them offer the doctor's degree in mass communications.

Young people who wish to prepare for newspaper work through a liberal arts curriculum should take English courses that include writing, as well as subjects such as sociology, political science, economics, history, psychology, and speech. Ability to read and speak in a foreign language and some familiarity with mathematics also are desirable. Those who look forward to becoming technical writers, or reporters in a special field such as science, should concentrate on course work in their subject matter areas as much as possible. (See statement on Technical Writers.)

The Armed Forces also provide some training in journalism. The Department of Defense maintains a Defense Information School at Fort Benjamin Harrison, Indianapolis, Ind.

Summer internships on newspapers, providing college students an opportunity to learn the rudiments of reporting or editing, are available from the Newspaper Fund and individual newspapers. Moreover, in addition to many loan programs, more than 2,800 journalism scholarships, fellowships, and assistantships were offered in 1970 by universities, newspapers, and professional organizations.

Important personal characteristics include a "nose for news," curiosity, persistence, initiative, resourcefulness, an accurate memory, and the physical stamina necessary for an active and often fast-paced life. Skill in typing generally is required since reporters usually must type their own news stories. On small papers, a knowledge of news photography also is valuable.

Some who compete for regular positions, find it is helpful to have had experience as a "stringer"—one who covers the news in a particular area of the community for a newspaper and is paid on the basis of the stories printed. Experience on a high school or college newspaper also may be helpful in obtaining employment.

Many beginners work on weekly or on small daily newspapers. Some college graduates are hired as general assignment reporters; others start on large city papers as copy editors. Beginning reporters usually are assigned to news events such as reporting on civic and club meetings, summarizing speeches, writing obituaries, interviewing important visitors to the community, and covering police court proceedings. As they gain experience, they may report more important developments, cover an assigned "beat," or specialize in a particular field of knowledge.

Newspapermen also may advance to reporting for larger papers or for press services and newspaper syndicates. Some experienced reporters become columnists, correspondents, editors, top executives, or publishers; these positions represent the top of the field and competition for them is keen. Other reporters transfer to related fields such as writing for magazines, or preparing copy for radio and television news reports.

Employment Outlook

Well-qualified beginners with exceptional writing talent will find favorable employment opportunities through the 1970's. In 1970, editors of large newspapers were seeking young reporters with exceptional talent. Other beginners, however, were facing competition for jobs, especially on large city dailies, and probably will continue to do so. In addition to seeking young reporters with exceptional talent, editors also were looking for reporters who were qualified to handle news about highly specialized or technical subjects.

Weekly or daily newspapers located in small towns and suburban areas will continue to offer the most opportunities for beginners entering newspaper reporting. Openings arise on these papers as young people gain experience and transfer to reporting jobs on larger newspapers or to other types of work. Preference in employment on small papers is likely to be given to beginning reporters who are able to help with photography and other specialized aspects of newspaper work and are acquainted with the community.

Large city dailies will provide some openings for the inexperienced with good educational backgrounds and a flair for writing to enter as reporter trainees. Some opportunities may continue to be available for young people who enter as copy boys and advance to reporting jobs.

In addition to jobs in newspaper reporting, new college graduates who have journalism training may enter related fields such as advertising, public relations, trade and technical publishing, radio, and television. Some job opportunities also will be found in teaching journalism.

The broad field of mass communication, which has grown rapidly in recent years, will continue to expand in the future. Factors contributing to this continuing expansion include rising levels of education and income; increasing expenditures for newspaper, radio, and television advertising; and a growing number of trade and technical journals and various types of company publications. As newspapers share in this growth, employment of reporters is expected to increase slowly. The greatest number of job openings, more than a thousand each year, will continue to arise from the need to replace reporters who are promoted to editorial or other positions, transfer to other fields of work, retire, or leave the profession for other reasons.

Earnings and Working Conditions

Many daily newspapers have negotiated, with the American Newspaper Guild, contracts which set minimum wages based on experience and provide for annual salary increases. In 1970, the minimum starting salaries on most daily newspapers with Guild contracts ranged between $100 and $135 a week for reporters having no previous experience. On a few small dailies, the Guild minimum starting salaries were less than $90 a week; on a few large dailies, Guild minimum rates for beginning reporters exceeded $140 a week. Young persons working as copy boys earn less than new reporters; minimum Guild rates for copy boys with some experience ranged from about $65 to $120 a week.

On most dailies, minimum Guild rates for reporters who have some experience (usually for those with 4 to 6 years) ranged from $170 to $230 a week in 1970. Contract minimums for experienced reporters on a few small dailies were less than $160 a week; on a few large dailies, they were over $250 a week. Papers under Guild contracts often pay salaries higher than the minimum rates called for in their contracts. Particularly successful, experienced reporters on city dailies may earn over $300 a week.

Newspaper reporters on big city papers frequently work 7 to 7½ hours a day, 5 days a week; most other reporters generally work an 8-hour day, 40-hour week. Most of those employed by morning papers start work in the afternoon and finish about midnight. Many newspapers pay overtime rates for work performed after the regularly scheduled workday, or for more than 40 hours of work a week; they often provide various employee benefits such as paid vacations, group insurance, and pension plans.

Sources of Additional Information

Information about opportunities with daily newspapers may be obtained from:

American Newspaper Publishers Association, 750 Third Ave., New York, N.Y. 10017.

Information on opportunities in the newspaper field, as well as a list of scholarships, fellowships, assistantships, and loans available at colleges and universities, may be obtained from:

The Newspaper Fund, Inc., Box 300, Princeton, N.J. 08540.

Information on union wage rates is available from:

American Newspaper Guild, Research Department, 1126 16th St. NW., Washington, D.C. 20036.

General information on journalism opportunities may be obtained from:

American Council on Education for Journalism, School of Journalism, University of Missouri, Columbia, Mo. 65201.

Association for Education In Journalism, 425 Henry Mall, University of Wisconsin, Madison, Wis. 53706.

Sigma Delta Chi, 35 East Wacker Drive, Chicago, Ill. 60601.

Names and locations of daily newspapers and a list of departments and schools of journalism are published in the *Editor and Publisher International Yearbook*, available in most large newspaper offices and public libraries.

TECHNICAL WRITERS

(D.O.T. 139.288)

Nature of the Work

The many technical and scientific developments of recent years have created a growing demand for writers skilled in interpreting these developments. The technical writer organizes, writes, and edits material about science and technology so that it is in a form most useful to those who need to use it—be it a technician or repairman, a scientist or engineer, an executive, or a housewife. When writing for the nonspecialist, he must present his material in a simple, clear, and factual manner; for the specialist, he must include technical detail, using a highly specialized vocabulary. Regardless of what kind of writing he does, the technical writer serves to establish easy communication between scientists, engineers, and other technical specialists, and the users of their information.

The technical writer's product takes many forms, such as a publicity release on a company's scientific or technical achievement or a manufacturer's contract proposal to the Federal Government. It may be a manual that explains how to operate, assemble, disassemble, maintain, or overhaul components of a missile system or a home appliance. Technical writers also write for scientific and engineering periodicals and for popular magazines.

Technical writers, as defined in this statement, include only those people primarily employed to interpret, write about, or edit technical or scientific subject matter. It excludes those primarily employed as scientists, engineers, or other techni-

Technical writer discusses project with engineer.

cal specialists who also do a considerable amount of writing.

Before starting a writing assignment, a technical writer usually must research his subject. This process involves studying reports, reading technical journals, and consulting with the engineers, scientists, and other technical personnel who have worked on the project. Then he prepares a rough draft that may be revised several times before it is in final form. Technical writers usually arrange for the preparation of tables, charts, illustrations, and other artwork, and in so doing may work with technical illustrators, draftsmen, or photographers.

Places of Employment

An estimated 20,000 technical writers and editors were employed in 1970. Most technical writers are employed in the electronics and aerospace industries. Many work for research and development firms or for the Federal Government—mainly in the Departments of Defense and Agriculture, the Atomic Energy Commission, and the National Aeronautics and Space Administration. Some work in firms that specialize in technical writing. Others are in business for themselves as freelance technical writers.

Technical writers are employed all over the country, but primarily in the Northeastern States, Texas, and California. They are concentrated in the Washington, D.C., Los Angeles-Long Beach, Houston, Fort Worth-Dallas, Chicago, New York, Boston, St. Louis, Kansas City, Denver, and Philadelphia metropolitan areas.

Training, Other Qualifications, and Advancement

The bachelor's degree is the desirable minimum entrance requirement for work in this field, although talented and experienced writers having less academic training may qualify. Employers do not agree on the most appropriate kind of college training needed by technical writers, but graduates usually must have a combination of courses in writing and scientific and technical subjects. Some employers prefer applicants who have degrees in engineering or science who have had courses in writing. Others seek graduates who majored in English or journalism and have taken some courses in scientific and technical subjects. Regardless of the college training they prefer, all employers place great emphasis on writing skills.

An increasing number of schools offer formal undergraduate programs leading to a bachelor's degree in technical writing or technical journalism. Some schools now offer graduate work and degrees in the field. In addition, about 170 colleges and universities provide professional education leading to a bachelor's degree in journalism; most of these offer at least one course in technical writing or technical journalism as part of the regular curriculum. Liberal arts colleges and some engineering schools offer English and other courses that sharpen writing skills. Many colleges and universities conduct short-term summer workshops and seminars for technical writers.

When still in high school young people who plan to become technical writers should supplement the required science and mathematics courses with as many elective courses in grammar and composition as possible. They also may gain helpful experience by working as editors or writers for their school papers.

In addition to the ability to write well, technical writers must be able to think logically, and should also like to do detailed accurate work. They should be able to work and communicate well with others, since they often work as part of a team. At other times, however, technical writers must work alone with little or no supervision.

Beginners often assist experienced technical writers by doing library research, by editing, and by preparing drafts of portions of reports. Experienced writers in organizations that have large technical writing staffs may advance to positions of technical editors or progress to supervisory and administrative positions. After gaining experience and contacts, a few may open their own job shops.

It also is possible to advance by becoming a specialist in a particular scientific or technical subject. These writers sometimes prepare syndicated newspaper columns or articles for popular magazines.

Employment Outlook

Well-qualified and experienced technical writers are expected to find good employment opportunities through the 1970's. Beginners who have good writing ability and appropriate education also should find many opportunities; those who have minimum qualifications will find stiff competition for jobs, however. The greatest demand probably will be for technical writers with backgrounds in electronics and communications to work in the aerospace and related industries, particularly in research and development activities.

The employment of technical writers is expected to increase moderately during the 1970's, because of the need to put the increasing volume of scientific and technical information into language that can be understood by management for decision making and by technicians for operating and maintaining complicated industrial equipment. Also, since many products will continue to be assembled from components manufactured by different companies, technical writers will be in demand to describe, in simple terms, the interrelationships of these components. The growth in this occupation will be accelerated also by the need for improved and simplified operating and maintenance instructions for new consumer products.

The demand for technical writers will continue to be related to research and development expenditures. During the 1970–80 decade research and development expenditures of Government and industry are expected to increase, although at a slower rate than during the 1960's. The anticipated slowdown in Federal R&D spending basically reflects anticipated reductions in the relative importance of the space and defense components of R&D expenditures. These trends were evidenced in the late 1960's and in 1970.

Technical writers who have training in journalism also will find opportunities in other fields that employ writers, such as advertising, public relations, trade publishing, and radio and television broadcasting. In addition to new opportunities resulting from growth expected in this profession, hundreds of technical writers will be needed each year to replace those who retire, die, or transfer to other occupations.

Earnings and Working Conditions

In 1970, inexperienced technical writers having bachelor's degrees were hired in private industry at starting salaries ranging from $6,000 to $8,000 a year; those who have moderate experience earned from $8,000 to $12,000 a year; highly experienced writers earned from $12,000 to $16,000; and those in supervisory and management positions, up to $20,000 or more. Differences in the earnings of experienced writers depended not only on their ability and previous experience, but also on factors such as the type, size, and location of their employing firms. Earnings of freelance technical writers vary greatly and are related to the writer's reputation in the field.

In the Federal Government in late 1970, inexperienced technical writers with a bachelor's degree and credit for about five science courses could start at either $6,548 or $8,098 a year, depending on their college records. Those who have 2 years' experience could begin at $9,881 and with 3 years' experience, $11,905.

Technical writers usually work

the standard 40-hour week. They may work under considerable pressure, frequently working overtime when a deadline has to be met on a publication or report.

Sources of Additional Information

Additional information on this occupation, including a list of schools offering accepted courses of study and specific training programs in accredited colleges and universities, may be obtained from:

Society for Technical Communications, Inc., Suite 421, 1010 Vermont Ave. NW., Washington, D.C. 20005.

OTHER PROFESSIONAL AND RELATED OCCUPATIONS

ARCHITECTS

(D.O.T. 001.081)

Nature of the Work

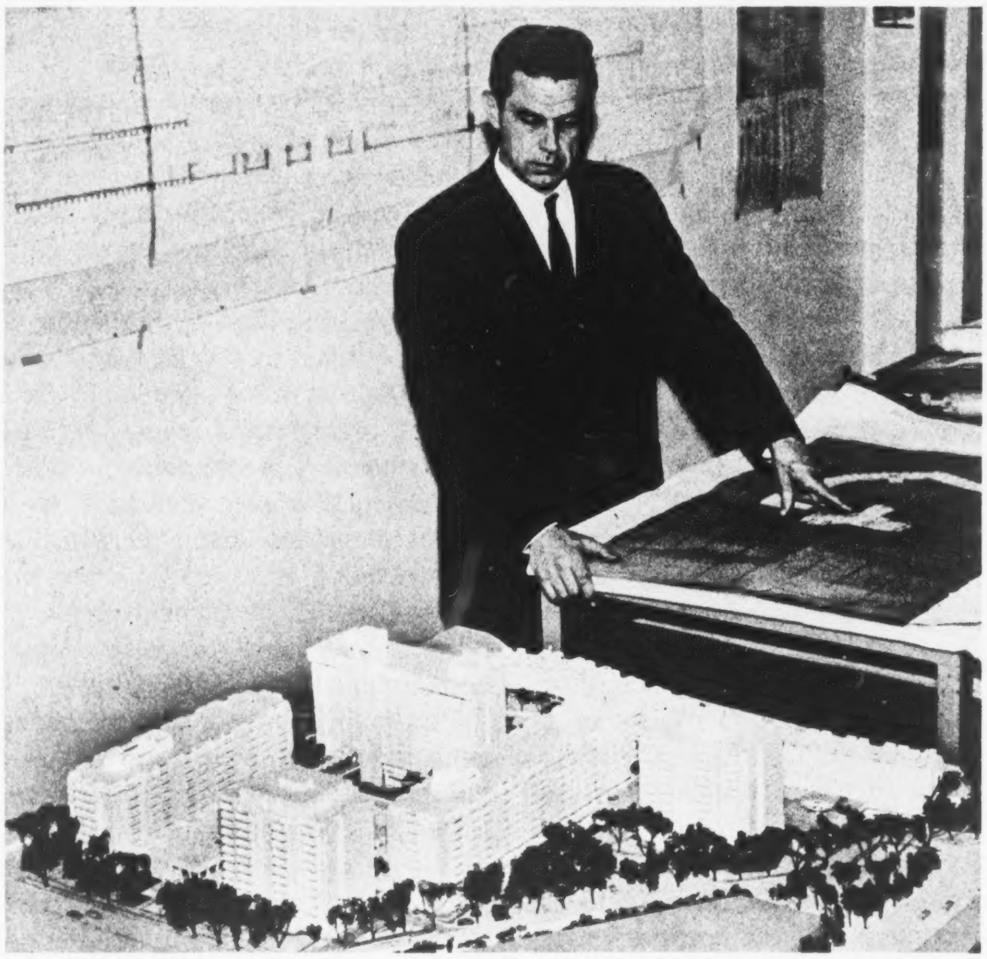
Architects plan and design buildings and other structures that are safe, useful, and pleasant in appearance. Architects also work with other professionals, such as engineers, urban planners, and landscape architects, to design cities and towns and plan and improve overall physical environments.

When an architect is commissioned to design a building, he discusses with the client the purpose, requirements, and cost limitations, as well as preferences as to style and plan. Subsequently, the architect makes hundreds of decisions and considers not only the requirements of the building, but also local and State building codes, zoning laws, fire regulations, and other ordinances. For example, in planning a school, the architect must decide the amount of corridor and stairway space which students need to move easily from one class to another; the type and arrangement of storage space, and the location, size, and interior of classrooms, laboratories, lunchroom, gymnasium, and administrative offices.

The architect makes preliminary drawings of the structure and meets with the client to develop a final design. This design includes floor plans and the interior and exterior details of the building. The final design then is translated into working drawings, showing the exact dimensions of every part of the structure and the location of the plumbing, heating, electrical, air-conditioning, and other equipment. Consulting engineers usually prepare detailed drawings of the structural, plumbing, heating, and electrical work. Engineers' drawings are coordinated with the architect's working drawings, and specifications are prepared listing the construction materials to be used, the equipment, and, in some cases, the furnishings.

The architect then assists his client in selecting a building contractor and in negotiating the contract between client and contractor, and he acts as the client's advisor and representative in dealings with the contractor. As construction proceeds, the architect makes periodic visits to the construction site to see if the design is being followed, and that the materials specified in the contract are being used. The architect's work is not completed until the project is finished, all required tests are made, and guarantees are received from the contractor.

Most self-employed architects plan and design a wide variety of structures, ranging from homes to churches, hospitals, office buildings, and airports. They also plan and design multibuilding complexes for urban renewal projects, college campuses, industrial parks, and new towns. Some architects specialize in one particular type of structure or project. When working on large-scale projects or for large architectural firms, architects frequently specialize in one phase of the work, such as design, drafting, specification writing, or construction contract administration (insuring that a



structure is built according to plans and specifications).

Places of Employment

An estimated 33,000 registered (licensed) architects were employed in the United States in late 1970. In addition, many other architectural school graduates who are unlicensed were working in positions requiring a knowledge of architecture. About 4 percent of all architects are women.

Approximately two-fifths of all architects are self-employed, either practicing individually or as partners. Most of the others work for architectural firms. Some architects work for engineers, builders, real estate firms, and for other businesses having large construction programs. Others are employed by government agencies, often in fields such as city and community planning and urban redevelopment. About 1,500 of these are employed by the Federal Government.

Architects are employed in all parts of the country. However, they are concentrated in those States with large metropolitan areas. Nearly half of all architects are employed in six States—California, New York, Illinois, Texas, Pennsylvania, and Ohio.

Training, Other Qualifications, and Advancement

A license for the practice of architecture is required by law in all States and the District of Columbia, mainly to insure that architectural work which may affect the safety of life, health, or property is done by qualified architects. Requirements for admission to the licensing examination are set by the individual States. These generally include graduation from an accredited professional school followed by 3 years of practical experience in an architect's office. As a substitute for formal training, most States accept longer periods of practical experience (usually 10 to 12 years) for admission to the licensing examination.

In 1970, professional training in architecture was offered by 85 colleges and universities in the United States, 67 of which were accredited by the National Architectural Accrediting Board. Most of these schools offered a 5-year curriculum leading to the bachelor of architecture degree. Many architectural schools also offered graduate education leading to the master's degree, and a few schools offered the Ph. D. degree. Graduate training is not essential for the practice of architecture, but is often desirable for research and teaching positions.

Most schools of architecture admit qualified high school graduates who meet the entrance requirements of the college or university with which the school is associated. Some schools require 1 or 2 years of college education before admitting the student to a 3- or 4-year architectural training program. In general, architectural schools prefer that students' preparation include mathematics, science, social studies, language, and art. A typical curriculum includes architectural courses as well as English, mathematics, physics, chemistry, sociology, economics, and a foreign language.

Persons planning a career in architecture should have a capacity to master technical problems, a gift for artistic creation, and a flair for business and for human relations. Students are frequently encouraged to work for architects or for building contractors during summers to gain knowledge of practical problems.

New graduates usually begin as junior draftsmen in architectural firms where they make drawings and models of building projects or draft details in the working drawings. As they gain experience, they are given more complex work. After several years, they may progress to chief or senior draftsman, with responsibility for all the major details of a set of working drawings and for the supervision of other draftsmen. Other architects may work as designers, construction contract administrators, or specification writers. An employee who is particularly valued by his firm may be designated an associate and may receive, in addition to his salary, a share of the profits. Usually, however, the architect's goal is to establish his own practice.

Employment Outlook

The outlook is for continued rapid growth of the profession through the 1970's. Employment opportunities are expected to be favorable both for experienced architects and for new graduates.

A major factor contributing to this favorable outlook is the expected growth in the volume of nonresidential construction—the major area of work for architects. Moreover, the increasing size and complexity of modern nonresidental buildings, as well as the homeowners' growing awareness of the value of architects' services, are likely to bring about a greater demand for architectural services. Urban redevelopment and city and community planning projects, other growing areas of employment for architects, also are expected to increase considerably in the years ahead. (See statement on Urban Planners.) In addition, expanding college enrollments will create a need for additional architects to teach architectural courses.

Besides those needed to fill new positions due to growth, deaths and retirements will account for about 1,000 new openings every year.

Along with the anticipated rise in demand for architects, an increase is expected in the number of architectural graduates. If this field follows the trend expected in all college graduations, the number of architectural degrees awarded each year during the 1970's should be considerably greater than the estimated 4900 awarded in 1970. However, many architectural graduates work in fields such as sales and administration in the building industry and do not enter the profession. Thus, those who choose to enter the field and become registered should have good employment opportunities through the 1970's.

Earnings and Working Conditions

Starting salaries of architectural school graduates employed in private industry were generally between $120 and $160 a week in 1970, according to available information. Draftsmen having 3 years' experience or more earned between $135 and $180 a week; job captains, specification writers, and other senior employees usually earned from $150 to $250 a week. Senior employees often receive yearly bonuses in addition to their salaries.

Architects well established in private practice generally earn much more than high-paid salaried employees of architectural firms. The range in their incomes is very wide, however. Some architects that have many years of experience and good reputations earn well over $25,000 a year. Young architects starting their own practices may go through a period when their expenses are greater than their income.

Depending on their college records, architects having bachelor's degrees and no experience could start in the Federal Government in 1970 at either $8,510 or $10,528 a year. Architects who had completed all requirements for the master's degree could start at $10,528 or $11,855; those having the Ph. D. degree could begin at either $13,493 or $14,665 a year.

Most architects work in well-lighted, well-equipped offices and spend long hours at the drawing board. However, their routine often is varied by interviewing clients or contractors or discussing the design, construction procedures, or building materials of a project with other architects or engineers. Architects involved in construction contract administration frequently work out of doors during inspections at construction sites.

Sources of Additional Information

General information about careers in architecture is included in a number of publications of the American Institute of Architects; a catalog of publications is available, as well as two free publications, "Designing a Better Tomorrow" and "Your Building, Your Architect." They can be obtained from:

The American Institute of Architects, 1785 Massachusetts Ave., NW., Washington, D.C. 20036.

COLLEGE CAREER PLANNING AND PLACEMENT COUNSELORS

(D.O.T. 166.268)

Nature of the Work

Career planning and placement counselors, sometimes called college placement officers, provide a variety of services to college students and alumni. They are concerned with the aspects of a student's development involving his career selection: studying himself, exploring and choosing an occupational area, making a decision either to pursue graduate study or to enter the labor market. They also aid students in obtaining part-time and summer positions to meet an economic need or to assist in career exploration.

They arrange for employer representatives to visit the campus to discuss their firms' personnel needs and to interview qualified applicants. Career planning and placement counselors provide information about students to employer representatives and assist in appraising the qualifications of students. They also make new contacts with employers to develop additional employment opportunities. In addition, they may suggest improvements in employer recruitment literature and inform the college faculty of any change in job requirements that might warrant adjustment in curriculum.

Many assemble and maintain a library of career guidance information and recruitment literature from public and private sources for the use of students and alumni. Such material includes information on various occupations, together with data on current opportunities, educational requirements, earnings, ad-

College career planning and placement counselor and student discuss employment offers.

vancement, and the long-term outlook.

Placement counselors may specialize in areas such as law and part-time and summer work. However, the extent of specialization usually depends upon the size and type of the college, as well as the size of the placement staff.

Places of Employment

Nearly all colleges and universities offer career planning and placement services. Large colleges may employ several counselors working under a director of placement activities; in many institutions, however, a combination of placement functions is performed by one director and his clerical staff. In some colleges, especially the smaller ones, the functions of counselors may be performed on a part-time basis by members of the faculty or administrative staff. Universities frequently have placement offices for each major branch or campus. In most universities, there is a central office which coordinates the work of all career planning and placement counselors; in some, each office works as a separate unit.

An estimated 2,800 career planning and placement counselors were employed in 4-year colleges and universities in 1970, most of them on a full-time basis. Of this total number, about one-fourth were women. In addition, an increasing number of placement officers are employed full-time or part-time in 2-year colleges.

Training, Other Qualifications, and Advancement

No specific education program exists to prepare persons for college career planning and placement work. However, a bachelor's degree, preferably in one of the behavioral sciences, is considered the minimum requirement for entry into the field.

In 1970, more than 100 colleges and universities offered programs leading to a graduate degree in college student personnel work. Graduate study is becoming increasingly important for career counseling and placement workers. Graduate courses that are considered helpful include counseling theory and techniques, vocational testing, theory of group dynamics, and occupational research and employment trends.

Some persons enter the career planning and placement field after gaining a broad background of experience in business, industry, government, or educational organizations. Also helpful is an internship in a career planning and placement office.

Persons who would like to enter the career planning and placement field should have an interest in people. They must be able to communicate with and gain the confidence of students, faculty, and employers. The ability to develop a keen insight into the employment problems of both employers and students and to maintain honest and confidential communications also is important in college placement work. They must be energetic and able to work under pressure and to organize and administer a wide variety of tasks.

Advancement for career planning and placement professionals usually is through promotion to an assistant or associate position, placement director, director of student personnel services, or to some other higher level administrative position. However, the extent of such opportunity usually depends upon the type of college or university and the size of the staff.

Employment Outlook

The number of job opportunities in the college career planning and placement field is expected to rise very rapidly through the 1970's. In general, employment prospects will be good for new or recent college graduates seeking beginning positions.

Among the factors expected to contribute to the favorable outlook for college career planning and placement counselors are the increasing number of college students; a growing number of minority group students and students from low-income families who require special counseling and assistance in obtaining part-time jobs to help finance their education; the expansion of counseling and placement programs on many campuses as greater recognition is given to the need for such programs; and the increasing number of two-year institutions and the establishment of career counseling and placement offices on these campuses.

Regional college placement associations and their coordinating organization, the College Placement Council, foster activities to upgrade and expand existing career planning and placement programs and encourage the establishment of placement services where none presently exist. The results of their efforts should create additional job opportunities for professional personnel in this field.

Some openings also will occur each year as placement officers transfer to other positions, retire, or leave the field for other reasons.

Earnings and Working Conditions

In 1970, annual earnings of placement office directors ranged from less than $5,000 to a high of over $27,500, with the median salary about $12,250, according to a National Education Association survey of public and private colleges and universities. The survey reports that annual earnings of deans of testing and counseling in 1970 ranged from under $6,500 to more than $29,500 with a median salary of $13,800. In general, the larger institutions paid the highest salaries.

Career planning and placement professionals frequently work more than a 40-hour week; irregular hours and overtime often are necessary, particularly during the "recruiting season." Most placement personnel are employed on a 12-month basis. They are paid for holidays and vacations, and receive the same benefits as other professional personnel employed by colleges and universities.

Sources of Additional Information

The College Placement Council, Inc., P.O. Box 2263, Bethelem, Pa. 18001.

HOME ECONOMISTS

(D.O.T. 096.128)

Nature of the Work

Improving products, services, and practices that affect the comfort and well-being of the family is the primary function of home economists. These professional workers have a broad knowledge of the home economics field or are specialists in a particular area, such as food, clothing and textiles, housing, home furnishings and equipment, child development, household management, or family economics.

Teachers make up the largest group of home economists. Secondary school teachers instruct classes in food, nutrition, clothing, textiles, child development, family relations, home furnishings, home management, and consumer education. In addition, they may sponsor local chapters of Future Homemakers of America and conduct related activities. Other work done by home economics teachers is similar to that described in the statement on Secondary School Teachers, elsewhere in this *Handbook*. Teachers in adult education programs help homemak-

Home economist teaches cooking.

ers to increase their understanding of family relations and to improve their homemaking skills. They also train those who wish to prepare for jobs in home economics. College teachers may combine teaching and research, and often specialize in one particular area of home economics.

Private business firms and trade associations employ home economists to promote the development, use, and care of specific home products. These home economists may do research; test products; prepare advertisements and booklets with instructional materials; plan, prepare, and present programs for radio and television; serve as consultants; give lectures and demonstrations before the public; and conduct classes for such workers as salesmen and appliance servicemen. They also may study consumer needs and help manufacturers translate these needs into useful products.

Home economists employed by food manufacturers often work in test kitchens or laboratories to improve products or help create new products. They may also publicize the nutritional value of specific foods. Those employed by utility companies describe the operation and benefits of appliances and services and often give advice on household problems. Home economists employed by manufacturers of kitchen and laundry equipment may work with engineers on product development. Those engaged in communications work for magazines, newspapers, radio and television stations, advertising and public relations agencies, trade associations, and other organizations. They usually prepare articles, advertisements, and speeches about home products and services. Their work may include product testing and analysis, and the study of consumer buying habits. Still other home economists work for dress-pattern companies, department stores, interior design studios, and other business firms that design, manufacture, and sell products for the home. A small number of home economists are employed in financial institutions, giving customers advice on spending, saving, and budgeting.

Some home economists are engaged in research for the Federal Government, State agricultural experiment stations, colleges, universities, and private organizations. The U.S. Department of Agriculture employs the largest group of these workers, some of whom study the buying and spending habits of farm families, and then develop budget guides. A few in other Federal agencies are engaged in research on space travel, working on such problems as food needs in outer space.

Cooperative Extension Service home economists conduct adult education programs for women and 4-H Club programs for girls in such areas as home management, consumer education, family relations, and nutrition.

Home economists employed on social-welfare programs by Federal, State, county, city, and private welfare agencies may act as advisers and consultants on household budgets and improved homemaking. They help handicapped homemakers and their families adjust to physical limitations by changing the arrangements in the home and revising methods of work. Other home economists in welfare agencies supervise or train workers who provide temporary or part-time help to households disrupted by illness.

Places of Employment

About 105,000 persons were employed in home economics occupations in 1970. This figure includes an estimated 30,000 dietitians and approximately 5,200 extension workers who are discussed in separate statements on Dietitians and Cooperative Extension Service Workers in the *Handbook*. About 65,000 home economists were teachers. Approximately 45,000 were secondary school teachers. About 13,500 were adult education instructors, some of whom also taught part-time in secondary schools. In addition, there were about 4,000 college and university teachers. The remainder taught in elementary schools, kindergartens, nursery schools, recreation centers, and other institutions. More than 5,000 home economists were in private business firms and associations. Several hundred were government research workers, and some worked in social welfare programs. A few were self-employed.

Although home economics is generally considered a woman's field, a growing number of men are employed in home economics positions. Most men specialize in foods and institution management, though some are in the family relations and child development field, applied arts, and other areas.

Training, Other Qualifications, and Advancement

Approximately 400 colleges and universities offer training leading to a bachelor's degree in home economics, which qualifies graduates for most entry positions in the field. A master's or doctor's degree is required for college teaching, for certain research and supervisory positions, for work as an extension specialist or supervisor, and for some jobs in the nutrition field.

The undergraduate curriculum in

home economics gives students a strong background in science and liberal arts and also includes courses in each of the areas of home economics. Students majoring in home economics may specialize in various subject-matter areas. Advanced courses in chemistry and nutrition are important for work in foods and nutrition; science and statistics for research work; and journalism for advertising, public relations work, and all other work in the communications field. To teach home economics in a high school, a student must complete the professional education courses and other State requirements for a teacher's certificate.

Scholarships, fellowships, and assistantships are available for undergraduate and graduate study. Although colleges and universities offer most of these financial grants, government agencies, research foundations, businesses, and the American Home Economics Association Foundation provide additional funds.

Home economists must be able to work with people of various living standards and backgrounds and should have a capacity for leadership, including an ability to inspire cooperation. Good grooming, poise, and an interest in people also are essential, particularly when dealing with the public. The ability to communicate effectively is also important.

Employment Outlook

Home economists are expected to have good employment opportunities through the 1970's. The greatest demand will stem from the need to fill teaching positions in secondary schools and in colleges and universities. Many business establishments also are becoming increasingly aware of the contributions that can be made by professionally trained home economists and probably will hire more of them to promote home products and to act as consultants to customers. Increased national focus on the needs of low-income families may also increase the demand for home economists. In addition, the need for more home economists in research is expected to increase because of the continued interest in improving home products and services.

Many home economists will be needed to replace those who die, retire, or leave the field because of family responsibilities or other reasons through the 1970's. Opportunities for those who leave the profession but later wish to return will be good, especially as part-time teachers in adult education programs.

Earnings and Working Conditions

Home economics teachers in public schools generally receive the same salaries as other teachers, as most school districts have a single-salary schedule, based on education and experience. In school districts of 100,000 pupils or more, the median salary of beginning teachers who have a bachelor's degree was $7,200 for the school year 1970–71, according to a National Education Association survey; in districts of 50,000 to 99,999 enrollment, the median starting salary was $6,800; and in districts of 25,000 to 49,999 enrollment, $6,850. The median salary of home economics instructors teaching in colleges and universities was about $8,360 a year in 1969–70.

In 1970, average annual salaries received in the Cooperative Extension Service were as follows: inexperienced county extension home economists, $7,000; experienced county extension home economists, $9,600; and State specialists, $13,400.

The Federal Government paid inexperienced workers who have a bachelor's degree in home economics $6,548 or $8,098 in late 1970, depending on their scholastic records. For those having additional education and experience, salaries generally ranged from $9,881 to $16,760 a year, depending upon the type of position and level of responsibility.

Many home economists work a regular 40-hour week or less. Those in teaching and extension positions, however, frequently work longer hours as they are expected to be available for evening lectures, demonstrations, and other work. Most home economists receive fringe benefits, such as paid vacation, sick leave, retirement pay, and insurance benefits.

Sources of Additional Information

A list of schools granting degrees in home economics is available from:

Home Economics Education, Bureau of Adult, Vocational, and Technical Education, Division of Vocational and Technical Education, U.S. Department of Health, Education, and Welfare, Washington, D.C. 20202.

Additional information about careers in this profession, the types of home economic majors offered in each school granting degrees in home economics, and graduate scholarships may be obtained from:

American Home Economics Association, 2010 Massachusetts Avenue, NW., Washington, D.C. 20036.

LANDSCAPING ARCHITECTS

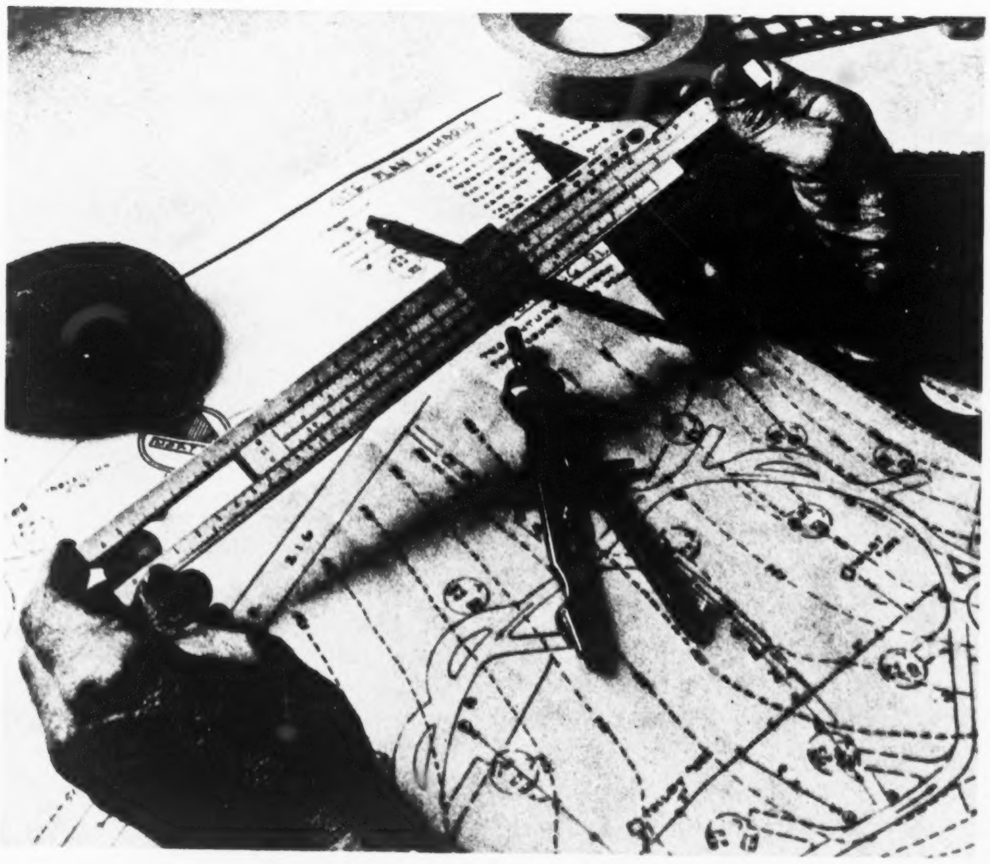
(D.O.T. 019.081)

Nature of the Work

Everyone enjoys walking through an attractively designed park or driving along a scenic road. Landscape architects plan, design, and supervise the arrangement of these outdoor areas for people to use and enjoy. The attractiveness of parks, highways, housing projects, campuses, and country clubs reflects the skill of these architects in designing useful and pleasing landscapes. Their knowledge of site planning allows landscape architects to serve many types of clients, from a real estate firm embarking on a new suburban development to a city preparing to build an airport.

Landscape architects may plan the entire arrangement of a site and supervise the grading, construction, and planting required to carry out the plan. Whether they perform all or only part of these services on a particular project, however, depends on the client's wishes and the available funds.

To plan a site, landscape architects first study the nature and purpose of the client's project, and the various types of structures needed. Next, they study the site itself, observing and mapping features such as the slope of the land and the position of existing buildings and trees. They also consider the parts of the site that will be sunny or shaded at different times of the day, the structure of the soil, existing utilities, and many other factors. Then, after consultation with the architect and engineer working on the project, they draw up preliminary plans for the development of the site. After the client approves the preliminary plans, working drawings are made which show all existing and proposed features such as buildings, roads, walks, terraces, grading, and drainage structures in planted areas. Landscape architects outline in detail the methods of constructing features such as walks and terraces and draw up lists of materials to be used. Landscape contractors then are invited to submit bids for the work.



Landscape architect plans site design.

Firms of landscape architects usually handle a wide variety of assignments. Some, however, specialize in projects such as parks and playgrounds, campuses, hotels and resorts, shopping centers, roads, or public housing.

Places of Employment

An estimated 10,000 landscape architects were employed in 1970. The majority were self-employed or worked for other landscape architects in private firms. About one-third of all landscape architects were employed by government agencies concerned with public housing, city planning, urban renewal, highways, and parks and recreational areas. Some were on the staffs of engineering firms; others were employed by landscape contractors and a few taught in colleges and universities.

Training, Other Qualifications, and Advancement

A bachelor's degree in landscape architecture is usually the minimum requirement for entering the profession. This training is offered in at least 64 colleges and universities, of which 24 have been accredited by the American Society of Landscape Architects. Another 40 schools offer courses in landscape architecture but not a complete 4-year program. The curriculum for the bachelor's degree requires 4 to 5 years of study, depending on the institution. Fifteen universities also offer master's degrees in landscape architecture.

Entrance requirements for the landscape architecture course are usually the same as those for admission to the liberal arts college of the same university. Some schools also require completion of a high school course in mechanical or geometrical drawing, and most schools advise high school students to take courses in art and more mathematics than the minimum required for college entrance.

Courses in design, including architecture and drawing as well as landscape design, constitute over half of the typical curriculum in landscape architecture. Other major fields of study are civil engineering and horticulture. In addition, courses in English, science, the social sciences, and mathematics usually are required. A bachelor's degree in landscape architecture provides a good background for graduate work in city planning.

Young people who plan to become landscape architects should be interested in both art and nature, for the profession demands a talent for design and an understanding of plant life, as well as technical ability. Successful practice as an independent landscape architect also requires a good business sense and the ability to deal with people.

Working for landscape architects or landscape contractors during summer vacations will help the student to discover the phases of landscape architecture that interest him most and may better qualify him for employment upon graduation.

New graduates usually begin as junior draftsmen, or designers tracing drawings and doing other simple drafting work. As their skill increases, they progress to more responsible work. After 2 or 3 years, they usually become registered as landscape architects and are qualified to carry a design through all stages, from preliminary sketches to finished working drawings. Experienced draftsmen often handle other aspects of landscape architects' work also, such as preparing specifications and detailing methods of construction. Employees who demonstrate ability for all phases of work may become associates of the firm; landscape architects who progress this far often open their own offices.

A license is required for the independent practice of landscape architecture in 20 States—Arizona, California, Colorado, Connecticut, Florida, Georgia, Hawaii, Kansas, Louisiana, Massachusetts, Michigan, Nebraska, New York, North Carolina, Ohio, Oregon, Pennsylvania, Texas, Utah and Washington. Candidates for the licensing examination are usually required to have 6 to 8 years' experience, or a degree from an accredited school of landscape architecture plus 2 to 4 years' experience.

Employment Outlook

Employment opportunities for graduates that have professional training in landscape architecture are expected to be favorable throughout the 1970's. The profession probably will continue to expand in the years ahead as a result of the continued growth of metropolitan areas with their needs for parks and recreational areas, the growing population's requirements for outdoor recreational facilities, the continued increase in public construction (including public housing), and the rising interest in city and regional planning. The expected increase in homeownership, coupled with rising per capita incomes and living standards, also will spur the demand for landscape architects.

Women represent between 10 and 15 percent of all landscape architects. Well-trained and competent women landscape architects can look forward to interesting and worthwhile careers in the profession, particularly as specialists in garden and planting design.

Earnings and Working Conditions

In 1970, starting salaries in private offices for new graduates having bachelors' degrees in landscape architecture ranged from about $7,000 to $9,000 annually; holders of master's degrees generally earned starting salaries between $12,000 and $15,000. Experienced persons employed by private firms typically earned from about $15,000 to $20,000 a year, although it was not unusual for especially well-qualified people to receive annual salaries of more than $25,000.

Landscape architects in independent practice often earn more than salaried employees with considerable experience, but their earnings may vary widely and may fluctuate from year to year.

In the Federal Civil Service in 1970, newly graduated landscape architects were paid annual entrance salaries of either $8,510 or $10,528 depending on their qualifications. Others with advanced degrees earned between $11,855 and

$13,493. The salary schedule also provides for periodic increases above this amount.

Salaried employees both in the government and in landscape architectural firms usually work regular hours. Self-employed persons often work long hours, especially during the latter stages of a project. Salaried employees in private firms may also work overtime during seasonal rush periods.

Sources of Additional Information

Additional information on the profession and a list of colleges and universities offering accredited courses of study in landscape architecture may be obtained from:

American Society of Landscape Architects, Inc., 2013 I St., NW., Washington, D.C. 20006.

For information on a career as a landscape architect in the Forest Service, write to:

U.S. Department of Agriculture, Forest Service, Washington, D.C. 20250.

LAWYERS

(D.O.T. 110.108, .118 and 119.168)

Nature of the Work

When people need legal help they retain lawyers, who advise them of their rights and obligations and, when necessary, represent them in courts of law. In addition, lawyers (also called *attorneys*) negotiate settlements out of court and represent clients before quasi-judicial and administrative agencies of the government, such as the Internal Revenue Service and the Social Security Administration. They may act as trustees, guardians, or executors. Government attorneys play a large part in developing and administering Federal and State laws and programs; they prepare drafts of proposed legislation, establish law enforcement procedures, and argue cases.

Most lawyers are engaged in general practice, handling all kinds of legal work for clients. However, a significant number specialize in one branch of law, such as corporation, criminal, labor, patent, real estate, tax, or international law. Some attorneys devote themselves entirely to trying cases in the courts. Others never appear in court but instead spend all their time drawing up wills, trusts, contracts, mortgages, and other legal documents; conducting out-of-court negotiations; and doing the investigative and other legal work necessary to prepare for trials. Still others are primarily engaged in teaching, research, writing, or administrative activities.

Many people who have legal training are not employed as lawyers but are in other occupations where they can use their knowledge of law. They may, for example, be insurance adjusters, tax collectors, probation officers, credit investigators, or claims examiners. A legal background also is a valuable asset to people seeking or holding public office.

Places of Employment

About 280,000 lawyers were employed in 1970, the great majority working full time. Of the total number almost three-fourths were in private practice. About half of the private practitioners were in practice by themselves; the other half were in partnership or working for other lawyers or law firms.

Government agencies employ the greatest number of salaried attorneys. In 1970, about 10,000 attorneys worked for the Federal Government, chiefly in the Justice, Defense and Treasury Departments, and the Veterans Administration. About twice as many attorneys were employed by State and local government. Other salaried lawyers are employed by private companies, such as large manufacturing firms, banks, and insurance companies.

Most of the remainder teach in law schools. Some lawyers in salaried legal positions also have an independent practice; others do legal work on a part-time basis working primarily in another occupation. Most lawyers work in cities and in the more populous States.

Training, Other Qualifications, and Advancement

Before a person can practice law in the courts of any State, he must be admitted to its bar. In all States, applicants for bar admission must pass a written examination; however, a few States waive this requirement for graduates of their own law schools. Other usual requirements are U.S. citizenship and good moral character. A lawyer who has been admitted to the bar in one State can usually be admitted in another without taking an examination, provided he meets that State's standards of good moral character and has a specified period of legal experience. The special rules of each court or agency control the right to practice before Federal courts and agencies.

To qualify for the bar examinations in the majority of States, an applicant must have completed a minimum of 3 years of college work and, in addition, must be a graduate of a law school approved by the American Bar Association or the proper State authorities. A few States will accept as qualification study of the law wholly in a law office or in combination with study in a law school. Only one State will accept study of the law by correspondence. A number of States require registration and approval by the State Board of Examiners before students enter law school or during the early years of legal study. In a few States, candidates must complete a period of clerkship in a law office before they are admitted to the bar.

As a rule, 7 years of full-time study after high school is necessary to complete the required college and law school work. The most usual preparation for becoming a lawyer is 4 years of college study followed by 3 years in law school. However, many law schools admit students after only 3 years of college work. A few schools may accept students after 2 years of college work. On the other hand, an increasing number of law schools are requiring applicants to have a college degree. Law schools seldom specify the college subjects which must be included in students' prelegal education. However, English, history, economics and other social sciences, logic, and public speaking are all important for prospective lawyers. In general, their college background should be broad enough to give them an understanding of society and its institutions. Students interested in a particular aspect of the law may find it helpful to take related courses; for example, engineering and science courses for the prospective patent attorney, and accounting for the future tax lawyer.

Prospective lawyers should also enjoy working with people and be capable of winning their confidence.

Acceptance by most law schools is dependent upon the applicant's ability to demonstrate an aptitude for the study of law, usually through the "Law School Admissions Test."

Of the 173 law schools in existence in 1970, 148 were approved by the American Bar Association and the others—chiefly night schools—were approved by State authorities only. A substantial number of full-time law schools have night divisions designed to meet the needs of part-time students; some law schools have only night classes. Four years of part-time study are usually required to complete the night-school curriculum. In 1969, almost a quarter of all law students in ABA approved schools were enrolled in evening classes.

The first 2 years of law school are generally devoted to fundamental courses such as contracts, criminal law, property law, and judicial procedure. In the third year, students may elect courses in specialized fields such as tax, labor, or corporation law. Practical experience is often obtained by participating in school-sponsored legal aid activities, in the school's practice court where students conduct trials under the supervision of experienced lawyers, as well as by writing on legal issues for the school's law journal. Graduates receive the degree of juris doctor (J.D.) from many schools, although other schools confer the bachelor of laws (LL.B.) as the first professional degree. Advanced study is often desirable for those planning to specialize or to engage in research and law-school teaching.

Most beginning lawyers start in salaried positions, although some go into independent practice immediately after passing the bar examination. Young salaried attorneys usually act as assistants (law clerks) to experienced lawyers or judges. Initially, their work is limited to research, such as checking points of law; they rarely see a client or argue a case in court. After several years of progressively responsible salaried employment, many lawyers go into practice for themselves. Some lawyers, after years of practice, become judges.

Employment Outlook

Graduates from highly regarded

law schools, as well as those who rank high in their classes, will have good employment prospects through the 1970's. They should find opportunities for salaried positions with well-known law firms, on the legal staffs of corporations and government agencies, and as law clerks to judges. Graduates of the less prominent schools and those who graduate with lower scholastic ratings may experience some difficulty in finding salaried positions as lawyers. However, numerous opportunities will be available for law school graduates to enter a variety of other types of salaried positions requiring a knowledge of law.

Prospects for establishing a new practice will probably continue to be best in small towns and expanding suburban areas. In such communities, competition is likely to be less than in big cities, and rent and other business costs somewhat lower. Also, young lawyers may find it easier to become known to potential clients. On the other hand, salaried employment will be limited largely to metropolitan areas where the chief employers of legal talent—government agencies, law firms and big corporations—are concentrated. For many able and well-qualified lawyers, opportunities to advance will be available in both salaried employment and private practice.

Although the majority of employment opportunities for new lawyers will arise from the need to replace those who retire, die, or otherwise leave the field, the total number of lawyers is expected to grow moderately over the long run. Most of the growth will result from continuing expansion of business activity and population, and the increased use of legal services by low- and middle-income groups. For example, expansion of legal services for low-income groups has come about through the Community Action Programs authorized under the Economic Opportunity Act of 1964. In addition, the growing complexity of business and government activities is expected to create a steadily expanding demand for lawyers who have extensive experience in corporation, patent, administrative, labor, and international law. However, continuing a recent trend, the number of lawyers in independent practice may remain stable or decline somewhat.

Earnings and Working Conditions

In 1970, law firms in several States offered annual starting salaries as high as $15,000 to law school graduates from widely recognized schools or those having high academic standing. For lawyers employed by manufacturing and other business firms the average starting salary was over $11,500 a year in 1970; with 1 year's experience, over $13,000; and with a few years' experience, an average of $16,800. In the Federal Government, annual starting salaries for attorneys passing the bar were either $9,881 or $11,905 in 1970, depending upon their academic and personal qualifications. Those with a few years' experience earned $16,760 a year. Some exceptional government lawyers earned more than $35,000 annually.

Beginning lawyers engaged in legal aid work usually receive the lowest starting salaries. New lawyers starting their own practices may earn little more than expenses during the first few years and may work part time in another occupation.

Lawyers' earnings generally increase with experience. Those on a salaried basis receive increases as they assume greater responsibilities. In 1970, the average annual salary in private industry for those in charge of legal staffs was more than $33,000. Incomes of lawyers in private practice usually grow as their practice develops. Private practitioners who are partners in law firms generally have greater average incomes than those who practice alone.

Lawyers often work long hours and are under considerable pressure when a case is being tried. In addition, they must keep abreast of the latest laws and court decisions. However, since lawyers in private practice are able to determine their own hours and workload, many stay in practice until well past the usual retirement age.

Sources of Additional Information

The specific requirements for admission to the bar in a particular State may be obtained from the clerk of the Supreme Court or the secretary of the Board of Bar Examiners at that State capital. Information on law schools and on law as a career is available from:

Information Service, The American Bar Association, 1155 East 60th St., Chicago, Ill. 60637.

Association of American Law Schools, Suite 370, 1 Dupont Circle, NW., Washington, D.C. 20036.

LIBRARIANS

(D.O.T. 100.118 through .388)

Nature of the Work

Making information available is the job of librarians. Librarians select and organize collections of books, pamphlets, manuscripts, periodicals, clippings, and reports, and assist readers in their use. In many libraries, they also may make available phonograph records, maps, slides, pictures, tapes, films, paintings, braille and talking books, microfilms, and computer tapes and programs. In addition to classifying and cataloging books and other loan items, they publicize library services, study the reading interests of people served by the library, and provide a research and a reference service to various groups. Librarians also may review and abstract published materials and prepare bibliographies.

In small libraries, librarians perform a great variety of tasks. In a large library, each librarian may perform only a single function, such as cataloging, publicizing library services, or providing reference service, or he may specialize in a subject area such as science, business, the arts, or medicine.

Librarians are generally classified by the type of library in which they are employed: Public library, school media center, college or university library, or special library. There are two principal kinds of library work—reader services and technical services. Those who perform reader services—for example, reference librarians and children's librarians—work directly with the public. Librarians who perform technical services, such as catalogers or acquisition librarians, deal less frequently with the public.

Public librarians serve all kinds of readers—children, students, teachers, research workers, and others. Increasingly, librarians are providing special materials and services to culturally and educationally deprived persons and to physically handicapped persons unable to use conventional print. The professional staff of a large public library system may include the chief librarian, an assistant chief, and several division heads who plan and coordinate the work of the entire library system. This system also may include librarians who supervise branch libraries, and other librarians who are specialists in certain areas. The duties of some of these specialists are briefly described as follows:

Acquisition librarians purchase books and other library materials recommended by staff members, or requested by patrons, keep a well-balanced library in quantity and quality, make sure that the library receives what it orders, and maintain close contact with book jobbers and publishers. *Catalogers* classify books under various subjects and otherwise describe them so they may be located through catalogs on cards or in other forms. *Reference librarians* aid readers in their search for information—answering specific questions or suggesting sources of information. This work requires a thorough understanding of bibliographic material and a general knowledge of library materials in various subject fields. *Children's librarians* plan and direct special programs for young people. Their duties include helping children find books they will enjoy, instructing them in the use and content of the library, giving talks on books, conducting film programs, and maintaining contact with schools and community organizations. Often, they conduct regular story hours at libraries, playgrounds and day care centers, and sometimes on radio or television. *Adult services librarians* may select materials for adult readers and advise them. They are often asked to suggest reading materials, and to cooperate in or plan and conduct educational programs on such topics of adult interest as community development, public affairs, creative arts, problems of the aging, or home and family life. *Young adult services librarians* may select books and other materials for young people of junior high school and high school age and guide them in the use of these materials. They may arrange book or film discussion groups, concerts of recorded popular and classical music, and other programs related to the interests of young adults. They also may help to coordinate the services of the school libraries and the local public library. *Bookmobile librarians* take library materials into areas where public library services are nonexistent or inadequate, in inner city neighborhoods, migrant camps, and institutions such as hospitals and homes for the aged and others.

School media specialists (school librarians) instruct students in the use of the library and visit classrooms to familiarize students with print and nonprint materials relating to the subjects being taught. They also work with teachers and school supervisors in planning and developing units of study and independent study programs and participate in team teaching. They prepare lists of printed and nonprinted materials on certain subjects; meet with faculty members to select materials for school programs; and select, order, and organize library materials. Many school media specialists are employed by school district central offices as supervisors to plan and coordinate library services for the entire school system, as catalogers and as librarians to administer professional libraries for teachers and administrators. Very large high schools may employ several media specialists, each responsible for a special function of the library program or for special subject materials.

College and university librarians work with students, faculty members, and research workers in general reference work or in a particular field of interest, such as law, medicine, economics, or music. In addition, they may teach one or more classes in the use of the library. A few librarians who are employed in university research projects operate documentation centers. Computers and other modern devices are being increasingly used to record and retrieve specialized information.

Special librarians work in libraries maintained by commercial and industrial firms, such as pharmaceutical companies, banks, advertising agencies, and research laboratories; professional and trade associations; government agencies; and other types of organizations such as hospitals and museums. They plan, acquire, organize, catalog, and retrieve information from collections designed to provide intensive coverage of information resources about subjects of special interest to the organization. Special librarians utilize their extensive knowledge of the subject matter, as well as of library science, in building library resources, advising and assisting library users, abstracting, and routing available materials. They must be able to evaluate the importance of new information to their organization. Literature searching and the preparation of summaries, translations, bibliographies, and special reports are among the major duties of special librarians. These operations may involve the use of electronic data processing equipment.

Information science specialists, like special librarians, work in technical libraries maintained by commercial and industrial firms. However, they must possess a more extensive technical and scientific background than special librarians. They not only perform many of the duties of special librarians, but they also develop coding and programing techniques for using electronic and electromechanical information storage devices and abstract complicated information into short, readable form, and interpret and analyze data for a highly specialized clientele.

Information on library technicians, is found in a separate statement in the *Handbook.*

Places of Employment

In 1970, about 125,000 persons were employed as professional librarians. Most of them worked full time. School librarians accounted for more than two-fifths of all librarians; public librarians represented nearly one-fourth; librarians in colleges and universities accounted for one-fifth; and those employed in special libraries (including libraries in government agencies), one out of seven. Some librarians were employed in correctional institutions, hospitals, and State institutions. A small number of librarians were employed as teachers and administrators in schools of library science.

More than 85 percent of all librarians are women. Men are more frequently employed than women in executive and administrative positions in large library systems and in special libraries concerned with science and technology.

Most librarians work in cities and towns. Those attached to bookmobile units serve widely scattered population groups, mostly in suburban or rural areas.

Training, Other Qualifications, and Advancement

To qualify as a professional librarian, one must ordinarily have completed a 1-year master's degree program in library science. A Ph. D. degree is an advantage to those who plan a teaching career in library schools or who aspire to a top administrative post, particularly in a college or university library or in a large school library system. For those who are interested in the special libraries field, a master's degree or doctorate in the subject of the library's specialization also is highly desirable.

In 1970, 46 library schools in the United States were accredited by the American Library Association. Many other colleges offer courses within their 4-year undergraduate programs, as well as at the graduate level, which prepare students for some types of library work.

Entrance requirements to most graduate schools of library science include (1) graduation from an accredited 4-year college or university, (2) a good undergraduate record, and (3) a reading knowledge of at least one foreign language. Some schools also require introductory undergraduate courses in library science. Most library schools prefer a liberal arts background and majors in areas such as social sciences, physical and biological sciences, the arts, or comparative literature. Some schools require entrance examinations.

Special librarians and science information specialists must have extensive knowledge of their subject matter as well as training in library science. In libraries devoted to scientific information, librarians should be proficient in one foreign language or more. They also must be well informed about new equipment, methods, and techniques used in storing and recalling technical information.

Many students attend library schools under cooperative work-study programs, combining their academic program with practical work experience in a library. Most library schools make every effort to arrange the student's schedule to permit him to take the necessary courses while working part-time. Scholarships for training in library science are available under certain State and Federal programs and from library schools, as well as from a number of the large libraries and library associations. Loans, assistantships, and financial aids also are available.

School librarians must be certified in most States as having met the requirements for both librarians and teachers. Sometimes local, county, or State authorities establish other requirements, that are based on different combinations of education and experience. In the Federal Government, beginning positions require completion of a 4-year college course and all the work required for a master's degree in library science or the equivalent in experience and education.

In addition to an appropriate educational background, a person interested in becoming a librarian should have an interest in people, intellectual curiosity, an ability to express himself clearly, a desire to search for recorded materials and use them, and an ability to work with others.

Experienced librarians may advance to administrative positions or to specialized work. However, promotion to these positions is limited primarily to those who have completed graduate training in a library school, or to those who have had specialized training.

Employment Outlook

The employment outlook for trained librarians is expected to be good through the 1970's. The best opportunities probably will be in school and college and university libraries, especially in research, subject specialties, and some languages. Some librarians will probably continue to find opportunities for employment in the Armed Forces and the U.S. Information Agency overseas.

Persons who have only a bachelor's degree with a major in library science, probably will encounter stiff competition in finding professional level jobs. Many part-time positions also will be available for persons trained in library work.

The demand for qualified librarians to meet the requirements of a growing and increasingly well-educated population will be intensified by the vast and continuing expansion in the volume and variety of materials which must be processed for reader use. Because of the ever-increasing demands upon high-level executives in business and industry, management will rely more heavily on the services of special librarians and science information specialists to keep abreast of new developments. Expanding use of computers to store and retrieve information also will contribute to increased demands for science information specialists. The increase of Federal grant assistance through the Library Services and Construction Act, the Medical Assistance Act, the Elementary and Secondary Education Act, and the Higher Education Act may further increase the demand for librarians. Improved standards for school media centers and college libraries and the expanding student population also will contribute to the demand for librarians. Additional librarians will be needed to provide services to inmates and patients in correctional institutions and to residents in schools for the blind, deaf, and handicapped people who cannot use conventional materials.

In addition to openings resulting from growth of the occupation, many librarians also will be needed each year to fill positions vacated by young women who leave their jobs to care for their families, and to replace librarians who transfer to other types of work, retire, or leave the field for other reasons. Opportunities for women wishing to reenter the field also will be favorable.

Earnings and Working Conditions

The annual starting salary of new library school graduates averaged about $8,700 in 1970. The degree of responsibility and technical skill required, as well as geographic location, size, and type of library, are important factors determining individual salaries. The higher paying positions generally are found in college, school, and special libraries. College and university libraries offered an average beginning salary of about $8,700 in 1970. New graduates employed in special libraries received about $8,400; those employed in public libraries averaged about $8,100. Librarians having extensive experience and information specialists having a Ph. D. degree in a subject matter field generally earned between $10,000 and $15,000 a year.

Qualified special librarians can usually expect to earn salaries in excess of those paid to public and school librarians because of their additional specialized subject training. The annual salary for all special librarians was $11,800 in 1970, but head librarians reported an average salary of $13,600, with a few making over $20,000 a year. Information science specialists received an average of $12,000 a year in 1970.

In the Federal Government, the annual entrance salary for librarians having a master's degree in library science was $9,881 in 1970. Experienced librarians generally earned from $10,200 to $19,800.

The typical workweek for librarians is 5 days, ranging from 35 to 40 hours. The work schedule of public and college librarians may include some Saturday, Sunday, and evening work. School librarians generally have the same workday schedule as classroom teachers. A 40-hour week during normal business hours is common for government and other special librarians.

The usual paid vacation after a year's service is 3 to 4 weeks. Vacations may be longer in school libraries, and somewhat shorter in those operated by business and industry. Many librarians are covered by sick leave; life, health, and accident insurance; and pension plans.

Sources of Additional Information

Additional information, particularly on accredited programs, and scholarships or loans may be obtained from:

American Library Association, 50 East Huron St., Chicago, Ill. 60611.

Information on requirements of special librarians may be obtained from:

Special Libraries Association, 235 Park Ave., South, New York, N.Y. 10003.

Information on Federal assistance for library training under the Higher Education Act of 1965 may be obtained from:

Division of Library and Educational Facilities, Bureau of Libraries and Educational Technology, Office of Education, U.S. Department of Health, Education, and Welfare, Washington, D.C. 20202.

Those interested in a career in Federal libraries should write to:

Secretariat Federal Library Committee, Room 310, Library of Congress, Washington, D.C. 20540.

Information on information science specialists may be obtained from:

American Society for Information Science, 1140 Connecticut Avenue, NW., Washington, D.C. 20036.

Individual State library agencies can furnish information on scholarships available through their offices, on requirements for certification and general information about career prospects in their regions. State boards of education can furnish information on certification requirements and job opportunities for school librarians.

LIBRARY TECHNICIANS

(D.O.T. 249.368)

Nature of the Work

Library technicians assist librarians in furnishing information on library sciences, facilities, and rules; in assisting readers in the use of card catalogs and indexes to locate books and other materials; and in answering questions that require only brief consultation of standard references. In some libraries, they train and supervise the clerical staff.

Cataloging books is one of their most important duties. Such work includes identifying the title, author, edition, publisher, publication data, and number of pages. Notations in the card catalog reflect the use of a classification system other than the Library of Congress System. Some technicians catalog new editions of works and compare information in the new edition with that on the cards already in the library's catalog. In some libraries, technicians prepare orders for library materials by looking up prices and publisher information, maintain files of special materials, such as newspaper clippings and pictures, and arrange displays.

In a large library, technicians may maintain controls on checkouts, reserves, renewals, and overdue materials. They may operate and maintain audiovisual and data processing equipment, including photographs, slide projectors, and tape recorders, as well as readers that magnify, project on a screen, and sometimes print out information on microfilm and microfiche cards.

Places of Employment

An estimated 76,000 library technicians were employed in 1970; four-fifths were women. Most technicians were employed in public and school libraries. Smaller numbers worked in college and university libraries, and in business, medical, and other special libraries. In 1970, the Federal Government employed about 3,300 library technicians, chiefly in the Department of Defense and the Library of Congress.

Training, Other Qualifications, and Advancement

Most library technicians employed in 1968 were trained on-the-job in programs that required from 1 to 3 years to complete. Recently, however, an increasing number have received training in formal post-high school programs. In the future, a larger number of employers may require such training.

In 1970, about 115 colleges offered a 2-year program for library technicians which led to an associate of arts degree in library technology. Curriculums generally include one year of liberal arts and one year of library-related work, such as introductory courses in bibliographic science, and cataloging. Most programs also include an introduction to library organization, and the purposes, procedures, and development of libraries. Some offer training to familiarize the student with data processing and audiovisual materials.

The number of junior and community colleges that offer library technician programs is expected to increase rapidly in the future, continuing the trend of the 1960's. A high school diploma or its equivalent is the standard entrance requirement for both academic and on-the-job training programs. Many programs require that a student be proficient in typing. A few schools require on-the-job experience under the supervision of a librarian.

College programs for library technicians vary since many of them are established to meet a particular local need. For this reason, young people should select a program with care and obtain information on the curriculum, instructional facilities, faculty qualifications, and kinds of jobs obtained by graduates. Credits earned in a two-year college program in library technology may not apply toward a professional degree in library science.

Library technicians should enjoy detailed work, have manual dexterity, verbal ability to explain procedures and regulations, and numerical ability to handle circulation statistics. The job requires much standing, stooping, bending, and reaching.

Employment Outlook

The employment outlook is excellent for library technicians through the 1970's, particularly for graduates of academic programs. A growing population and recent Federal legislation authorizing funds to construct, expand, and improve libraries are factors that influence demand.

Several thousand technicians will be needed annually through the 1970's to replace those who die, retire, and transfer to other fields.

Earnings and Working Conditions

Salaries vary widely with the size of the community and the library system in which library technicians are employed. Starting salaries generally range from $5,000 to $6,300; experienced library technicians sometimes make over $9,000.

In the Federal Government, annual salaries generally ranged from $5,212 to $8,098 in 1970. A few technicians earned $9,881 a year or more.

Library technicians employed in public and private school systems usually work only during school hours. The work schedule in public and college libraries may include some weekend and evening hours. In government and special libraries, a 40-hour week is common.

Most libraries provide fringe benefits such as group insurance and retirement pay. Additional benefits offered by private business often include educational assistance programs. Library technicians employed by the Federal Government receive the same benefits as other Federal workers.

PHOTOGRAPHERS

(D.O.T. 143.062, .282 and .382)

Nature of the Work

Photography involves much more than just taking clear pictures. Skillful portrait photographers, for example, take pictures which not only are natural looking and attractive but which also express the personality of the individual. Photographing sports and other news events also requires special photographic skills, as do other areas of photographic work.

The work of photographers varies greatly, depending on the area of specialization; however, all photographers use equipment and materials that are basically the same. Photographers use a variety of still and motion picture cameras. These cameras may be equipped with telephoto, wide-angle, or other special lenses, and have different types of light filters that enable the photographer to obtain the particular effects desired in each picture. Photographers also utilize many kinds of film and must know which to use for each type of picture, lighting condition, and camera. The photographer must be able to select the proper filter to be used with different film. When taking pictures indoors or after dark, photographers use lighting equipment—flash bulbs or electronic flash for some pictures, flood lights and other special lights and reflectors for others. In addition, photographers must be able to execute the chemical and mechanical processing by which pictures are developed, enlarged, and printed. (See statement on Photographic Laboratory Occupations.) In small shops and photographic departments, the photographer often does all this technical work; as a rule, large studios employ photographic technicians to do the needed laboratory work. The procedures involved in taking motion pictures differ

Photographer adjusts distance scale.

greatly from those used in still photography and, therefore, most photographers restrict themselves to either one field or the other.

Photographers also need some knowledge of art and design, and they should know how to use makeup and props. In addition, photographers must be able to arrange their subjects properly against a setting.

Many professional photographers specialize in such areas as portrait photography, commercial photography, or industrial photography. Portrait photographers usually work in their own studios, although they also take pictures in people's homes and other places. Commercial photographers generally take pictures for use in advertising real estate, furniture, food, apparel, and other items, but they may also do other kinds of photographic work. The industrial photographer usually works for a single firm or company, taking pictures that are used in company publications and for advertising company products or services. He may take motion pictures of workers on the job and of equipment and machinery operating at high speed; these pictures are then used to simplify work methods or to improve the production process. Other photographic specialists include press photography (photo journalism that combines a "nose for news" with photographic ability); aerial photography; instrumentation photography; illustrative photography; educational photography (preparing slides, film strips, and movies for use in the classroom); and science and engineering photography (the development of photographic techniques for use in space photography and related fields). Some photographers teach in high schools or colleges, act as representatives of photographic equipment manufacturers, manage photo-finishing establishments, sell photographic equipment and supplies, produce documentary films, or do freelance work.

Places of Employment

About 65,000 photographers were employed in 1970. Approximately half of them worked in commercial studios—many in business for themselves, the rest as salaried employees. In addition, sizable numbers were employed in industry; some worked for Federal, State, and local government agencies; and others operated camera stores or worked on the staffs of newspapers and magazines. Still others worked as freelance photographers, taking many kinds of pictures and selling them to advertisers, magazines, and other customers.

Photographers work in all parts of the country, in small towns as well as large cities. They are concentrated, however, in States which are heavily populated—California, New York, Pennsylvania, Ohio and Illinois—and which also have great numbers of businesses and industrial establishments.

Training, Other Qualifications, and Advancement

After high school, young people may prepare for work as professional photographers through 2 or 3 years of on-the-job training in a commercial studio. A trainee generally starts by working in the darkroom, where he learns how to develop film and do other related work such as photo printing and enlarging. Later, he may set up lights and cameras or otherwise assist an experienced photographer in taking pictures.

Photographic training also can be obtained in many colleges and universities, trade schools, and technical institutes, or by taking correspondence school courses. There are colleges, universities, or other institutions in almost every State that offer courses in some area of photography. Several colleges and universities offer 4-year curriculums leading to a bachelor's degree with a major in photography. These curriculums include liberal arts subjects as well as courses in professional photography. The master's degree with a major in various specialized areas, such as color photography, is offered by some colleges and universities. A few institutions have 2-year curriculums leading to a certificate or an associate degree in photography. Training in design at art schools or institutes is also useful, although these schools usually do not provide the technical training for camera work. (See statement on Commerical Artists.) Some photographers are trained in 3-year apprenticeship programs. Also, many young people learn photographic skills while serving in the Armed Forces.

The kind and amount of training obtained greatly influences the type of photographic work for which a young person can qualify. Amateur photographic experience may be helpful to the young person considering entry jobs in this field.

Considerable post-high school training, plus some photographic experience, is usually needed to enter industrial, news, or scientific photography. Photographic work in scientific and engineering research generally requires a background in science or engineering, as well as skill in photography.

The prospective photographer

should have manual dexterity, good eyesight and color vision, as well as some artistic ability. In addition, a pleasant personality and the ability to put people at ease are needed by photographers. Imagination and originality are particularly important assets for successful careers in commercial photography or freelance work. For press photography, a knowledge of news values and the ability to act quickly are important.

Beginning photographers often work in established studios until they accumulate the capital and experience needed to start their own businesses, although some open their own immediately after completing their training.

Employment Outlook

Thousands of talented and well-trained photographers will be needed each year though the 1970's to fill new positions and replace those who retire, die, or stop working for other reasons. However, those with limited ability and training are likely to encounter competition and find few opportunities for advancement.

Competition for employment in the portrait and commercial fields of photography is expected to be keen; nevertheless, opportunities should exist for those who are competent and well trained. These fields may be entered easily, since a photographer can go into business for himself with a modest financial investment. Moreover, the available supply of portrait and commercial photographers is continually enlarged by people who are employed in other occupations but who take pictures in their spare time.

In coming years, the employment of industrial photographers is expected to rise at a more rapid rate than that of either portrait or commercial photographers. Major factors contributing to this growth are the increasing use of photographers in research and development and the more widespread production of audio-visual aids for use by business, industry, civic organizations, and government. Because of advances in photographic technology, such as more sophisticated cameras, improved color, and high-speed photography, more and more business concerns and other organizations are utilizing photographic work. Microfilming will offer employment opportunities for persons having basic photographic skills. In this process, photo methods are used to reduce large quantities of file material to 16 millimeter film for easier filing and retrieval. In addition, opportunities are expected to be favorable for photographers working in scientific and engineering photography, illustrative photography, photo-journalism, and other highly specialized areas that require a thorough knowledge of photography as well as training in a technical or scientific field. Population expansion and the growth of the suburbs also will create some opportunities for photographers to open studios in new shopping centers.

Earnings and Working Conditions

Beginning photographers generally earned from $125 to $140 a week in 1970, according to the limited information available. Many photographers who have established reputations earned much more.

Inexperienced photographers employed by most daily newspapers having contracts with the American Newspaper Guild received minimum starting salaries ranging from about $105 to $140 a week. For photographers employed by a few small daily newspapers, the Guild minimum starting salaries were less than $95 a week; on a few large dailies, Guild minimum rates for beginning photographers approached $200 a week or more. Minimum rates for newspaper photographers having some experience (usually for those with 4 to 6 years) averaged about $200 a week in 1970. Contract minimums for experienced newspaper photographers on a few small dailies were less than $165 a week; on a few large dailies, they ranged from about $260 to $290 a week. Photographers who have a science or engineering background usually received beginning salaries of between $9,000 and $10,000 a year.

Depending on the level of experience, the entrance salary of photographers in the Federal Civil Service ranged from $5,853 to $9,881 a year in 1970. In addition, the salary schedule provides for periodic increases above this amount. Most experienced photographers in the Federal Government earned between $6,500 and $14,000 a year; a few earned over $17,000 annually.

Self-employed photographers generally earn more than salaried workers, but their earnings are affected greatly by business conditions and many other factors such as the type and size of community and clientele.

Photographers who have salaried jobs usually work the standard 5-day, 40-hour week and receive benefits such as paid holidays, vacations, and sick leave. Photographers in business for themselves frequently work longer hours. Working conditions are generally pleasant. Freelance, press, and commercial photographers may be required to travel frequently.

Sources of Additional Information

Information about photography as a career, as well as a list of schools of photography, is available from:

Professional Photographers of America, Inc., 1090 Executive Way, Oak Leaf Commons, Des Plaines, Ill. 60018.

SYSTEMS ANALYSTS

(D.O.T. 033.187, 012.168, 020.081 and 020.088)

Nature of the Work

Systems analysts plan, schedule, and coordinate the activities necessary to develop systems which process data to solve business, scientific, or engineering problems. Individual parts of a problem are viewed within the context of the overall problem. Although a system can be developed to process data manually, mechanically, or with electronic computers, most systems analysts develop methods for computer usage. (This statement discusses only the work of systems analysts who devise systems using electronic computers to process data and solve problems.)

Business firms employ systems analysts to solve accounting, inventory, and other problems. With the assistance of managers or subject matter specialists, they determine the exact nature of the data-processing problem. Then systems analysts define, analyze, and structure the problem logically. They identify all of the data needed and define exactly the way it is to be processed. They prepare charts, tables, and diagrams to describe the processing system and the steps necessary to its operation. Systems analysts use various techniques as tools of analysis; these may include cost accounting, sampling, and mathematical methods. After analyzing the problem and devising a system for processing data, systems analysts recommend the equipment to be used and prepare instructions for programers. They also interpret and translate final results into terms that are understandable to management, subject matter specialists, or customers.

Data processing problems are vast and solutions so varied and complex that many systems analysts specialize in a particular area. For example, systems analysts who work for scientific or engineering organizations may determine the flight of a space vehicle. Other analysts may develop systems to plan and forecast sales or conduct marketing research.

Some analysts improve systems already in use to handle additional or different types of data. Others do research, described as advanced systems design, to devise new methods of systems analysis. Analysts engaged in this type of activity usually have mathematical, scientific, or engineering backgrounds.

Systems analysts, who are managers or administrators and responsible for overall systems design, assign analysts to various phases of a project. They also may plan, organize, and control systems analysis throughout the organization in which they work and prepare reports.

Places of Employment

More than 100,000 persons were estimated to be employed as systems analysts in 1970. They work

mainly for insurance companies, manufacturing concerns, banks, wholesale and retail businesses, and the Federal Government. A growing number of systems analysts are employed by universities and independent service organizations that furnish computer services to business firms and other organizations on a fee basis. Systems analysts work chiefly in large cities.

Training, Other Qualifications, and Advancement

There is no universally acceptable way of preparing for work in systems analysis. Some employers prefer that candidates have a bachelor's degree and experience in mathematics, science, engineering, accounting, or business. Other employers stress a graduate degree.

Educational preparation and experience often determine the kind of job opportunities available. For example, employers are likely to seek an analyst having a background in business administration to work in finance or similar areas; those having an engineering background are sought for engineering or scientifically oriented systems. Applicants also may qualify on the basis of professional experience in scientific, technical, or managerial occupations, or practical experience in data processing jobs such as computer operator or programer.

Most employers prefer to hire people who have had some experience in computer programing. A young person can learn to use electronic data-processing equipment on the job or can take special courses offered by his employer, computer manufacturers, or colleges. In the Federal Government, for example, systems analysts usually begin their careers as programers. After gaining some experience, they may be promoted to systems analyst trainees and later qualify as systems analysts.

In large electronic data-processing departments, a person who begins as a junior systems analyst and gains experience may be promoted to senior or lead systems analyst. Systems analysts having proven leadership ability also can advance to positions as manager of systems analysis or an electronic data-processing department.

Employment Outlook

Employment opportunities for systems analysts should be excellent through the 1970's. Systems analyst has ranked among the fastest growing professional occupations in recent years. However, because people having a systems analysis or similar background work in fields such as mathematics and science, employers have had difficulty recruiting these workers.

A growing demand for systems analysts will result from the rapid expansion of electronic data-processing systems in business and government. Greater emphasis will be placed on developing computer systems that will retrieve information more efficiently; solve complex business, scientific, and engineering problems; and monitor industrial processes. These developments and others, such as the extension of computer technology to small business, the use of systems analysis to determine plant and store location, and the growth of computer centers to serve individual clients for a fee, signify a rapid rise in employment.

In addition to opportunities due to growth, some openings will occur as systems analysts advance to more responsible positions or leave their jobs to enter other employment. Because many of the workers are young, relatively few positions will result from retirement or death.

Earnings and Working Conditions

In 1970, beginning salaries of systems analysts averaged between $8,950 and $12,700 a year, according to a private survey which covered more than 80,000 workers in business, government, and educational data-processing installations in all parts of the country. Earnings of experienced systems analysts averaged $14,300 annually, and in some cases they were paid $25,000 or more a year.

Systems analysts usually work about 40 hours a week—the same as other professional and office workers. Unlike many console operators who work on two or three shifts, systems analysts generally work only during the day. Occasionally, evening or weekend work may be necessary to complete emergency projects.

Sources of Additional Information

Additional information about the occupation of systems analyst may be obtained from the following sources:

American Federation of Information Processing Societies, 210 Summit Avenue, Montvale, N.J. 07645.

Data Processing Management Association, 505 Busse Highway, Park Ridge, Ill. 60068.

A list of reading materials on career opportunities in the data processing field may be obtained from:

Association for Computing Machinery, 1133 Avenue of the Americas, New York, N.Y. 10036.

PROGRAMERS

(D.O.T. 020.188)

Nature of the Work

An electronic computer, although sometimes called a "mechanical brain," can only follow step-by-step instructions. The programer prepares these instructions.

A computer not only makes mathematical calculations at fantastic speeds, but stores large amounts of data for later use. Because computers work with masses of information at tremendous speed and accuracy, they are used for much "data processing" that otherwise would require many employees. They handle varied assignments such as maintaining inventories and controlling production machinery in factories.

Every "problem" processed in a computer first must be carefully analyzed so that exact and logical steps for its solution can be worked out. An experienced programer or systems analyst does this preliminary work. (See the statement on systems analysts elsewhere in the Handbook.)

Once this preliminary work has been completed, the "program," or detailed instructions for processing the data, can be prepared by the programer. Exactly how he does this depends not only on the type of equipment to be used but on the nature of the problem. The mathematical calculations involved in billing a firm's customers, for example, are very different from those required in most kinds of scientific and technical work. The programing techniques also are different. Still other techniques are required in writing programing "aids" to reduce the amount of detail. Because of these differences, many programers specialize in certain kinds of work.

In business offices, computers frequently are used to bill customers, make up payrolls, and keep track of inventories. First, the programer determines what information is necessary to prepare the documents and the form in which it is entered on company records. He next makes a flow chart or diagram, showing in what order the computer must do each step. Then, he prepares detailed instructions for the computer's control unit to tell the machine exactly what to do with each piece of information. The programer also prepares an instruction sheet for the console operator to follow when the program is run. (The work of the console operator is described in the statement on Electronic Computer Operating Personnel.)

The final step in programing is "debugging"—that is, checking on whether the instructions have been correctly written and will produce the desired information. A program usually is debugged in two steps. First, the programer takes a sample of the data to be processed and reviews step by step exactly what will happen as the computer follows the series of instructions that make up the program. Then, after he has revised the instructions to take care of any difficulties that have appeared, he completes the test by having a trial run made in the computer. The console operator sometimes helps with this part of the debugging process.

A comparatively simple program can be made for a computer within a very few days. A program that deals with a complex problem or is designed to produce many different kinds of information may require a year or more of preparation—sometimes by a large number of programers. On involved problems, several programers at different levels of responsibility often work as a

Programer prepares flow chart.

team, under the supervision of a senior programer.

The programer may perform other related duties, such as designing forms to use in data presentation. In addition, existing programs must be updated to keep pace with administrative changes or to improve efficiency. Also, larger or newer model computers often require that programs be rewritten.

Places of Employment

Nearly 200,000 programers were employed in 1970. In addition, some professional workers such as engineers, scientists, mathematicians, economists, and accountants spend a portion of their time programing.

Programers are employed chiefly by large business organizations and government agencies. A great many work for insurance companies and banks, public utilities, wholesale and retail establishments, and manufacturing firms of almost every kind. A considerable number are government employees doing work related either to scientific and technical problems, or to the processing of the vast amount of paperwork that is handled in many government offices. In addition, a growing number of programers are employed by computer manufacturers and independent service organizations that furnish computer and programing services to business firms and other organizations on a fee basis.

Training, Other Qualifications, and Advancement

The special abilities most sought by employers when they hire programers are similar for all types of positions, but requirements regarding education and experience vary according to the problems with which the programer will be occupied. Some programers are college graduates having degrees in engineering, for example, whereas others have had years of experience in work such as accounting or inventory control. In selecting programers, employers look for people having an aptitude for logical thinking and the exacting kind of analysis that is part of the job. The work also calls for patience, persistence, and the ability to work with extreme accuracy. Ingenuity and imagination are particularly important in jobs where programers have to solve problems in new ways.

Organizations which use computers for science and engineering prefer programers who are college graduates having degrees in engineering, the physical sciences, mathematics, or computer science. Graduate degrees may be required for some positions; for almost all positions, an applicant who has no college training is at a severe disadvantage.

Employers who use computers to process business records may not require programers to have technical college training. Many employers promote qualified workers having previous experience in machine tabulation, payroll, or accounting. When hiring outsiders, employers usually prefer applicants having training beyond high school. College courses in data processing or accounting, business administration, engineering, or mathematics provide especially good preparation.

Entrance requirements for jobs in the Federal Government are similar to those in private industry. Applicants are required to have a college degree, preferably with training in mathematics or the equivalent work experience.

Young people interested in programing can acquire some of the necessary skills at a steadily increasing number of technical schools, colleges, and universities. Instruction ranges from introductory home study and extension courses to advanced computer technology at the graduate level. High school courses in computer programing also are offered in many parts of the country.

High school and post-high school instruction, however, do not entirely eliminate the need for on-the-job training. Since technology changes continually and each type of computer has its own special programing, some additional training usually is necessary.

Most beginners in this occupation attend training classes for a few weeks and then, as they work on minor programing assignments, continue with further specialized training. A year or more of experience usually is necessary before a programer can handle all aspects of his job without close supervision. Once he becomes skilled, his prospects for further advancement are good. Experienced and capable programers are in strong demand. In large organizations, employees may be promoted to systems analyst positions or senior programing jobs having supervisory responsibilities.

Employment Outlook

Many thousands of new jobs for programers will become available each year through the 1970's. Employment is expected to increase very rapidly, as the number of computer installations rises to meet the growing demand for data processing. The increase in employment is expected to be particularly sharp in firms that use computers to process business records or to control manufacturing processes.

The rise in employment is expected to be accompanied by changes in the nature of the work done by programers. Advances in programing techniques and equipment, such as the use of more advanced languages and program parts stored in libraries for future reference, will eliminate much of the routine work associated with writing a program. As a consequence, professionally trained personnel qualified to handle both programing and systems analysis are likely to be increasingly in demand, especially for work on scientific and engineering problems. For other positions, many of them in large business offices where the analysis is done by accountants and other subject matter experts, 2 years of post-high school training may provide a sufficient background for beginning programers.

Most of the openings for programers in the years just ahead will be new jobs that arise as the number of computer installations continues to increase, and computers are put to new uses. Some openings also will occur as programers advance to more responsible positions, or as they leave their jobs to enter other types of employment. Because this occupation includes many comparatively young workers, fewer positions are likely to become vacant because of retirement or death than in other occupations of similar size.

Earnings and Working Conditions

In 1970, beginning salaries for programers averaged $8,530 a year, according to a private survey which covered more than 80,000 data processing workers in all parts of the country. Experienced programers averaged $12,170 a year, with some earning up to $20,000 annually. The average salary for programers having supervisory duties was $14,250 a year; some programing supervisors earned up to $24,000 annually.

The survey indicated salaries varied substantially. Some workers earned up to five times as much as others in the same position. These differences were due to the data processed, the computer used, the industry, and its location.

Federal Government salaries for programers were comparable to those in private industry. The great majority earned between $8,100 and $14,200 a year. The minimum entrance salary for beginners was $6,550 a year in 1970, and the top salaries of experienced programers responsible for complex programing or supervisory and administrative work ranged to $22,900 or more a year.

Programers work about 40 hours a week. Unlike many computer console and auxiliary equipment operators who work on two or three shifts, programers usually work only during the day. Occasionally, evening or weekend work may be necessary.

Work places usually are modern offices, well-lighted and air conditioned. Employers recognize the desirability of providing the best possible work surroundings so that programers can concentrate more readily on the exacting analysis that is essential to their job.

Sources of Additional Information

Additional information about the occupation of programer may be obtained from:

Data Processing Management Association, 505 Busse Highway, Park Ridge, Ill. 60068.

American Federation of Information Processing Societies, 210 Summit Ave., Montvale, N.J. 07645.

A list of reading materials on career opportunities in programing may be obtained from:

Association for Computing Machinery, 1133 Avenue of the Americas, New York, N.Y. 10036.

PSYCHOLOGISTS

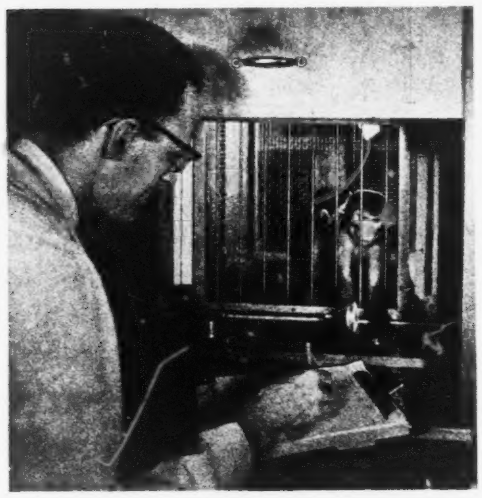
(D.O.T. 045.088 and .108)

Nature of the Work

The problems of severe emotional stress and abnormal behavior, the causes of low morale, or the effective performance of an astronaut, are among the concerns of psychologists seeking to understand people and to explain their actions. Psychologists study the behavior of individuals and groups and often help individuals achieve satisfactory personal adjustments. Their work includes varied activities such as teaching in colleges and universities; counseling individuals; planning and conducting training programs for workers; performing basic and applied research; advising on psychological methods and theories; and administering psychology programs in hospitals, clinics, research laboratories, and other places.

Psychologists obtain information about the capacities, traits, interests, behavior, and actions of people in several ways. They may interview individuals, develop and administer tests and rating scales, study personal histories, and conduct controlled experiments. In addition, psychologists often conduct surveys, either by personal interviews or by written questionnaires.

Psychologists usually specialize in one of the many interrelated branches of the profession. Clinical psychologists are the largest group of specialists. Generally, they work in mental hospitals or clinics and are concerned mainly with problems of mentally or emotionally disturbed people. They interview patients, give diagnostic tests, and provide individual and group psychotherapy. Other specialties in psychology include experimental psychology (the laboratory study of basic learning and motivation and sensory and perceptual processes); developmental psychology (the study of specific age groups such as young children, teenagers, and the aged); personality and social psychology (the study of human relationships to gain understanding of behavior); school psychology (concerned with psychological factors involved in the educational performance and general well being of school age children); comparative psychology (comparative behavior of different animals); physiological psychology (the relationship of behavior to physiological processes); counseling psychology (helping people achieve satisfactory personal, social, educational, or occupational adjustments); educational psychology (the study of educational processes); industrial psychology (developing techniques for selecting and training workers and improving worker motivation and morale); and engineering psychology (the study of man-machine and other complex system relationships).



Places of Employment

An estimated 40,000 psychologists were employed in 1970. About one-quarter are women.

Colleges and universities employ the largest number of psychologists —nearly three-fifths of the total. Government agencies—Federal, State, and local—employ the second largest group. Within the Federal Government, the agencies having the most psychologists are the Veterans Administration, the Department of Defense, and the Public Health Service.

Many psychologists also work in public schools, industry, and nonprofit foundations and clinics. Some are in independent practice, and others serve as commissioned officers in the Armed Forces and the Public Health Service.

Training, Other Qualifications, and Advancement

Generally, the master's degree with a major in psychology is the minimum educational requirement for professional employment in the field. Psychologists having this degree can qualify for positions where they administer and interpret psychological tests, collect and analyze statistical data, conduct research experiments, and perform administrative duties. In addition, they may teach in colleges, help counsel students or handicapped persons, or —if they have had previous teaching experience—act as school psychologists or counselors. (See statements on School Counselors and Rehabilitation Counselors.)

The Ph. D. degree is needed for many entrance positions and is becoming increasingly important for advancement. Psychologists having doctorates qualify for the more responsible research, clinical, and counseling positions, as well as for the higher level positions in colleges and universities, and in Federal and State programs.

At least 1 year of full-time graduate study is needed to earn the master's degree. An additional 3 to 5 years of graduate work usually is required for the Ph. D. degree. In clinical or counseling psychology, the requirements for the Ph. D. degree generally include an additional 1 year of internship or supervised experience.

Many graduate students receive financial help from universities and other sources in the form of fellowships, scholarships, or part-time employment. Several Federal agencies provide funds to graduate students, generally through the educational institution giving the training. The Veterans Administration offers a large number of predoctoral traineeships, during which time the students receive payments and gain supervised experience in VA hospitals and clinics. The Public Health Service provides funds for predoctoral and post doctoral traineeships and research fellowships. The National Science Foundation, the U.S. Office of Education, the Rehabilitation Services Administration, and the National Institute of Mental Health also provide fellowships, grants, and loans for advanced training in psychology.

The American Board of Examiners in Professional Psychology awards diplomas in the specialties of clinical, counseling, industrial, and school psychology to those having outstanding educational records and experience and who pass the required examinations.

Some universities require an undergraduate major in psychology for admission to graduate work in that field. Others prefer students with broader educational backgrounds, including not only some basic psychology courses but also courses in the biological, physical and social sciences, statistics, and mathematics.

Psychologists desiring to enter independent practice must meet certification or licensing requirements in an increasing number of States. In 1970, 42 States had these requirements.

Young persons who wish to pursue a career in psychology must be emotionally stable, socially mature, and able to deal effectively with people. Sensitivity, patience, and a genuine interest in others are particularly important attributes for work in clinical and counseling psychology. Research psychologists should be able to do detailed and independent work. Verbal and writing skills are necessary in communicating research findings.

Employment Outlook

Employment opportunities for psychologists having the Ph. D. degree are expected to be excellent through the 1970's. Psychologists holding master's degrees will be in demand, but their opportunities will be less favorable than for those having the Ph. D. degree.

Continued very rapid expansion of the profession is expected through the 1970's. Mental hospitals, correctional institutions, mental hygiene clinics, and community health centers which are currently understaffed, will need many clinical, counseling, and social psychologists in the future. Many openings for psychologists also are anticipated in the Federal Government, primarily in the Veterans Administration and the Department of Defense.

Increasing awareness of the need for testing and counseling children is expected to increase the need for psychologists in schools. In colleges and universities, more psychologists will be needed for student personnel work, as well as for teaching and research. Increased public concern for the development of human resources as evidenced by the Mental Retardation Facilities and Community Mental Health Centers Construction Act of 1963, as amended; and Medicare, Medicaid, and other federal programs will further increase the demand for psychologists.

Many vacancies also will occur each year as a result of retirements and deaths. The transfer of psychologists to do work of a purely administrative nature also may create some job vacancies. Most opportunities, however, will result from the rapid expansion that is anticipated for the profession.

Earnings and Working Conditions

In 1970, starting salaries for psychologists having a master's degree averaged about $9,600 a year, according to the American Psychological Association. Beginning salaries for those having the doctorate degree averaged $10,900.

The median annual salary for all psychologists in the National Science Foundation's Register of Scientific and Technical Personnel was $15,000 in 1970. The median salary for those having a Ph. D. was $16,000. According to the Register, self-employed psychologists generally have higher incomes than salaried employees.

Median salaries in graduate departments of psychology ranged from $11,700 for assistant professors to $19,200 for full professors during the academic year 1970–71 (9–10 months), according to a survey conducted for the Conference of Chairmen of Graduate Departments of Psychology.

In the Federal Government, psychologists having a Ph. D. degree and limited experience started at $13,493 in 1970. The annual average salary in the Department of Medicine and Surgery, Veterans Administration, which requires the doctoral degree for all specialties, was about $18,800 in 1970.

Sources of Additional Information

General information on career opportunities, certification or licensing requirements, and educational facilities and financial assistance for graduate students in psychology may be obtained from:

American Psychological Association,
1200 17th St. NW., Washington, D.C. 20036.

Information on traineeships and fellowships may be obtained from colleges and universities having graduate psychology departments.

RECREATION WORKERS

(D.O.T. 079.128, 187.118, 195.288)

Nature of the Work

Modern technological advances increasingly have raised the standard of living and provided leisure time for most people. How people spend their nonworking hours is now a major concern. Recreation workers help people to enjoy and use their leisure time constructively by organizing individual and group activities and by administering physical, social, and cultural programs for all age groups at camps, playgrounds, community centers, and hospitals. They also operate recreational facilities and study the recreation needs of individuals and communities.

Recreation workers employed by local government and voluntary agencies direct activities at neighborhood playgrounds and indoor recreation centers. They provide instruction in the arts and crafts and in sports such as tennis and basketball. They may supervise recreational activities at correctional institutions and work closely with social workers in organizing programs of recreation for the young and the aged at community centers and social welfare agencies.

Many persons work in industrial, hospital, military, or school recreation. Recreational workers in industry plan programs for company employees and organize bowling leagues, softball teams, and similar activities. Sometimes, they plan fund drives and company social functions. Hospital recreation workers plan recreation programs for the ill and the handicapped in hospitals, convalescent homes, and other institutions. Working under medical direction, they organize and direct sports, dramatics, and arts and crafts for persons suffering from mental problems and physical disabilities. School recreation workers organize the leisure-time activities of school-age children during school-days, weekends, and vacations.

Some part-time recreation workers and volunteers assist full-time workers throughout the year but mostly during the summer months. Part-time workers are largely college students and teachers. They work primarily as recreation leaders and camp counselors, organizing and leading games and other activities at camps and playgrounds.

Recreation worker instructs archery class.

Places of Employment

About 13,500 professional recreation workers were employed full time in 1970; about one-half are women. The majority worked for local governments and voluntary agencies. Most of the remainder were employed by religious organizations or by the Federal Government in national parks, the Armed Forces, the Veterans Administration, and correctional institutions. Some recreational workers were employed by industry, and a few taught in colleges and universities.

Recreation workers are employed in all parts of the country; however, a large proportion are employed in California, Massachusetts, New Jersey, New York, Ohio, Pennsylvania, and Texas.

Training, Other Qualifications, and Advancement

Most employers prefer college graduates who have majored in recreation, social science, or physical education for work in the recreation field. However, fewer than one-half of the recreation workers currently employed have this educational background. Persons interested in becoming recreation workers should take a broad range of courses in college. The typical program of study includes courses in communication, natural sciences, the humanities, philosophy, sociology, drama, and music. Specific courses in recreation include group leadership, program planning and organization, health and safety procedures, outdoor and indoor sports, dance, arts and crafts, and field work (actual recreation leadership experience).

Advanced courses in recreation or public administration leading to the master's degree are desirable for persons interested in higher level administrative postions. Students interested in industrial recreation may find it desirable to take courses in business administration; and those interested in working with the aged in hospitals as recreation specialists should take courses in psychology, health education, and sociology.

Training leading to a bachelor's degree with a major in recreation was available in over 130 schools in 1970. About 70 offered a master's degree and about 30 offered a doctorate in recreation. Over 60 junior colleges offer programs in recreation.

Young people planning a career as a recreation worker must have the ability to motivate people and be sensitive to their needs. Good health and physical stamina are required to participate in sports. Activity planning often calls for creativeness and resourcefulness. Since the recreation worker organizes sports, supervises art projects, and gives fund-raising speeches, he should have a variety of skills. Recreation workers should be able to accept responsibility and exercise judgment since they usually work alone.

To increase their leadership skills and understanding of people, students should obtain related work experience in high school and college. They may do volunteer, part-time, or summer work in recreation departments, camps, youth-serving organizations, institutions, and community centers.

Most college graduates entering the recreation field begin as leaders or specialists, although each year a small number of college graduates enter trainee programs that lead directly to recreation administration. A few large cities and organizations offer these programs which generally last 1 year.

The National Recreation and Park Association administers a national internship program to give advanced training and experience to graduates of recreation curriculums. Stipends varying from $6,000 to $8,000 a year are available.

Recreation leaders work directly with groups and individuals to organize and teach diversified activities, such as athletics and social recreation in indoor and outdoor centers. They also supervise nonprofessional workers and assist in administering recreation programs. Recreation specialists organize and develop one activity or several closely related activities. They sometimes oversee nonprofessional workers.

After a few years' experience, recreation leaders and specialists may become recreation directors; those having graduate training, however, may start at this level. Directors are responsible for the operation of the facilities, staff supervision, and the development and execution of programs at a particular recreation center, as well as the preparation of budgets and the analysis of recreation programs.

Opportunities for advancement to administrative positions often are limited for persons who have no graduate training. However, advancement is sometimes possible through a combination of education and experience. Administrative jobs require varying years of experience in full-time recreation work, depending upon the size of the community or organization and the program.

Employment Outlook

Employment of recreation workers is expected to increase very rapidly, through the 1970's. Several thousand recreation workers will be needed annually for growth and to replace personnel who leave the field because of retirements, deaths, or transfers to other occupations. In recent years, the number of college graduates having a major in recreation has fallen far short of the demand, and this pattern is expected to continue. Thus, many new recreation workers will continue to be hired from the fields of social science, physical education, and health education. Persons having less than full professional training also will find employment opportunities. As a result of the great demand for recreation workers, part-time and volunteer personnel will be needed, particularly in social welfare agencies and at the local government level.

Factors that will contribute to growth include increased leisure time and rising levels of per capita income. As income levels rise, more persons will participate in a variety of competitive and noncompetitive sports and larger numbers will travel to parks and resorts for camping, hiking, fishing, and other recreational pursuits. In addition, improvements in the national highway system will make many State parks and national forests more accessible to vacationing families. Population growth also will create a demand for more recreation workers to expand existing recreation programs and to aid larger numbers of mentally and physically handicapped persons. Longer life and earlier retirements will increase the number of clubs and organizations for retired persons, and thus increase the need for recreation workers.

Other reasons for the anticipated longrun expansion in the number of recreation workers include a growing interest and participation in recreation activities by the general population; the continued trend toward urban living; the rise in industrial recreation activities as more companies promote recreation programs for their employees; increased attention to physical fitness by government, educators, industry and others; and the initiation of programs to insure the preservation of outdoor recreation areas. A number of recent Federal laws also will contribute to the rising demand for recreation workers. Among these are the Elementary and Secondary Education Act of 1965, which includes provisions for grants to local educational agencies for improving and expanding recreation opportunities for the educationally deprived; and the Older Americans Act of 1965, which provides grants to States for programs, including recreation, for older persons.

Earnings and Working Conditions

Beginning recreation leaders having a bachelor's degree earned between $7,200 and $7,800 annually in 1970, according to the National Recreation and Park Association. In the same year, the salaries of recreation supervisors ranged from $8,500 to $10,000, depending upon their qualifications and the size of the community in which they were employed. Salaries of recreation directors or superintendents generally ranged from $12,000 in some small communities to over $22,000 in many large cities. Regions varied in their salary levels—higher salaries generally were paid in the West than in other areas of the country.

In 1970, the annual starting salary for inexperienced recreation workers in the Federal Government was $6,548 or $8,098, depending on their academic records or specialized training. Experienced recreation workers in Federal positions generally earned between $9,900 and $14,200 annually.

The average workweek for recreation workers is 40 hours, although some work upwards of 50 hours. A person entering the recreation field should expect some nightwork and irregular hours, for many recreation personnel work while other persons are enjoying their leisure time. Most public and private recreation agencies provide from 2 to 4 weeks' vacation and other fringe benefits, such as sick leave and hospital insurance.

Sources of Additional Information

Information about recreation as a career and about employment opportunities in the field may be obtained from:

National Industrial Recreation Association, 20 North Wacker Dr., Chicago, Ill. 60606.

National Recreation and Park Association, 1700 Pennsylvania Ave. NW., Washington, D.C. 20006.

Information about employment opportunities in Veterans Administration hospitals may be obtained directly from the hospitals or from the Department of Medicine and Surgery, Veterans Administration, Washington, D.C. 20421.

SOCIAL WORKERS

(D.O.T. 195.108, .118, .168, .208, and .228)

Nature of the Work

Development of a more complex urban society has greatly increased the need for organized social services. Social workers provide the link between these services, and individuals and families who are not able to provide for themselves or who need assistance in solving their problems.

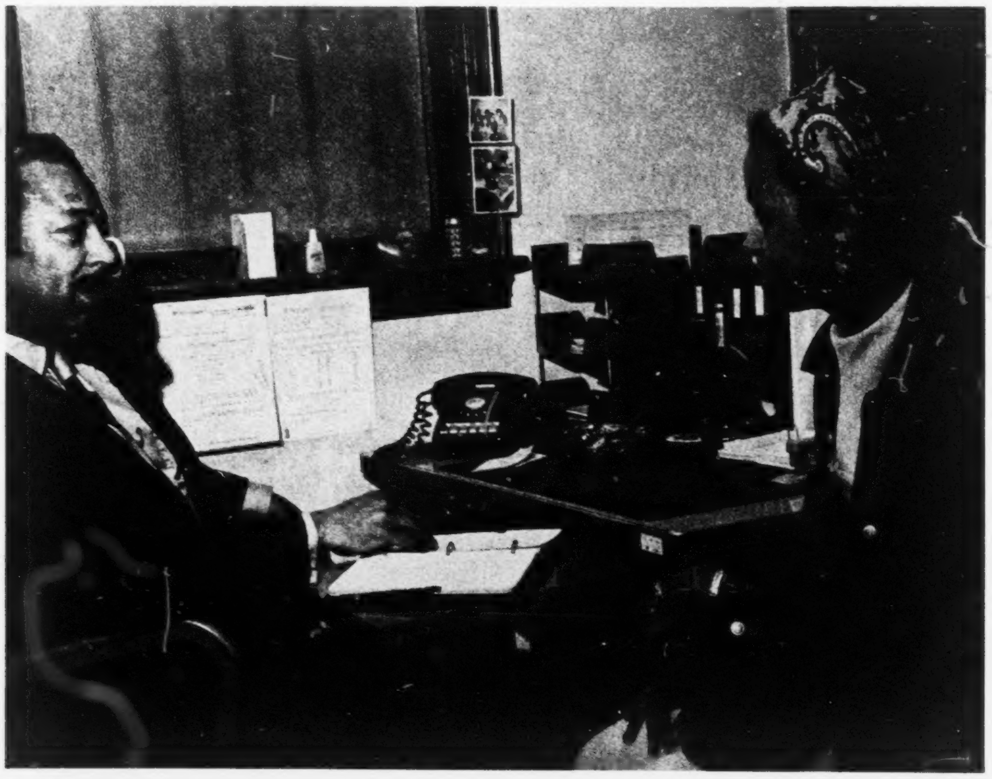
The problems which concern social workers include poverty; broken homes; physical, mental, and emotional handicaps; antisocial behavior; racial tensions; and unsatisfactory community conditions such as inadequate housing and medical care, and lack of educational, recreational, and cultural opportunities. A variety of public and voluntary agencies have social work programs designed to meet specific needs in specific ways: for example, income maintenance programs; family and child welfare services; social services for the crippled, disabled, ill, and aging; and programs for the prevention of juvenile delinquency. Many social work agencies emphasize service to individuals or families; some place primary emphasis on working with larger groups; and still others are concerned mainly with the community's social welfare.

Job titles may identify these three basic approaches as casework, group work, or community organization. The trend is for the social worker to use combinations of any two or all three approaches in problem-solving, however.

Caseworkers identify the social problems of individuals and families through interviews. They aid them in understanding their problems and in securing necessary services, including financial assistance, foster care, and homemaker service. Group workers help people through group activities to understand themselves and others better, and to work with others to achieve a common goal. They plan and conduct activities for children, adolescents, and older persons in a variety of settings, including settlement houses, hospitals, homes for the aged, and correctional institutions. Community organization workers help plan and develop health, housing, welfare, and recreation services for a neighborhood or larger area. They often coordinate existing social services and organize fund raising for community social welfare activities.

The majority of social workers provide social services directly to individuals, families, or groups. However, a substantial number perform executive, administrative, or supervisory duties. Others are college teachers, research workers, or consultants. The wide range of services provided by social workers is suggested by the descriptions of the principal areas of social work which follow:

Social workers in family service positions in State and local governments and voluntary agencies provide counseling and social services that strengthen family life and help clients to improve their social functioning. They also advise their clients on the constructive use of financial assistance and other social services.



Social workers in child welfare positions in government and voluntary agencies improve the physical and emotional well-being of deprived and troubled children and youth. They advise parents on child care and child rearing, counsel children and youth with social adjustment difficulties, arrange homemaker services during a mother's illness, institute legal action for the protection of neglected or mistreated children, provide services to unmarried parents, and counsel couples who wish to adopt children. They may place children in suitable adoption or foster homes or in specialized institutions.

Social workers employed by schools aid children whose unsatisfactory behavior or progress in school is related to their social problems. These workers consult and work with parents, teachers, counselors, and other school personnel in identifying and seeking a solution to the problems that hinder satisfactory adjustment.

Social workers employed by hospitals, clinics, health agencies, rehabilitation centers, and public welfare agencies aid patients and their families with social problems accompanying illness, recovery, and rehabilitation. They usually function as part of a medical team composed of physicians, therapists, and nurses.

Some social workers provide services for patients in mental health centers, hospitals, or clinics. As members of teams composed of psychiatrists, psychologists, and other professional personnel, they develop and report information on the patient's family and social background for use in diagnosis and treatment. They help patients respond to treatment and guide them in their social adjustment to their homes, jobs, and communities. They have particular responsibility for helping the families of patients to understand the nature of the illness. Social workers also participate in community mental health programs concerned with the prevention of mental illness and readjustment of mental patients to normal home and community living. Some conduct research.

Social workers in rehabilitation services assist emotionally or physically disabled persons in adjusting to the demands of everyday living. As part of a rehabilitation team, which usually includes physical or occupational therapists, these social workers serve as a link with the community while patients are in the hospital; later, they help them adjust to home and community life. (Rehabilitation counselors, a related occupational group, are discussed in a separate statement.)

Probation and parole officers and other correctional workers assist persons on probation and parole and juvenile offenders in readjusting to society. They investigate the social history and background of the person under the jurisdiction of the court and make reports to the court to help the judge in his judicial decisions. They also counsel persons on probation or parole, may help them secure necessary education or employment, and direct them to other services in the community. They also seek to resolve problems in marital and parent-child relationships.

Places of Employment

About 170,000 social workers were employed in 1970; about 60 percent worked in Federal, State, county and city government agencies. Most of the remainder were in voluntary or private agencies. A small number of experienced social workers from the United States were serving in other parts of the world as consultants, teachers, or technicians engaged in setting up agencies, schools, or assistance programs. They were employed by the Federal Government, the United Nations or one of its affiliated agencies, national professional associations, or voluntary agencies.

Training, Other Qualifications, and Advancement

A bachelor's degree, preferably in social welfare, generally is the minimum educational requirement for beginning jobs in social work. In most fields of practice, certain specialized areas require a master's degree in social work. For teaching positions, a master's degree in social work is required, and a doctorate is preferred. In research work, training in social science research methods is required, in addition to a graduate degree and experience in social work. In most States, beginners must pass a written examination in social work for employment in a government agency.

A master's degree in social work is awarded on successful completion of 2 years of specialized study and supervised field instruction in an accredited school of social work.

Social workers who have a master's degree and belong to the National Association of Social Workers are eligible for certification as members of the Academy of Certified Social Workers (ACSW).

In 1970, 70 graduate schools of social work in the United States were accredited by the Council on Social Work Education. For admission to these schools, a student must have a bachelor's degree representing broad knowledge of the liberal arts, preferably including courses in economics, history, political science, psychology, sociology, and social anthropology.

Many scholarships and fellowships are available for graduate education. Nearly two-thirds of the full-time students in graduate schools receive some type of financial aid from either the schools or employing agencies. Some social welfare agencies, both voluntary and public, offer plans whereby workers are granted "educational leave" to obtain graduate education. The agency may pay the expenses or a salary, or both.

Personal qualities essential for social workers include emotional maturity, objectivity, sensitivity, a basic concern for people and their social problems, and the ability to form and sustain good working relationships and to encourage social adjustment in others. Students should try to obtain as much related experience as possible during high school and college to determine whether they have the interest and capacity for professional social work. They may do volunteer, part-time, or summer work in places such as camps, settlement houses, community centers, or social welfare agencies. Some social welfare agencies, both voluntary and public, hire college students and, in some cases, high school students for nonclerical jobs in which the students assist social workers.

Employment Outlook

Employment opportunities for social workers are expected to be very good through the 1970's. Despite the anticipated increase in the number of graduates of master's degree programs in social work, the demand for these highly trained social workers is expected to continue to exceed the supply. The outlook for persons having a bachelor's degree in social welfare or in related fields will continue to be favorable. Qualified and experienced women who wish to work part time should have very good employment prospects.

Many factors will contribute to the need for more social workers to maintain existing programs and to staff new ones. The occupational structure of the economy is expected to continue to change and create severe problems for many unskilled workers and others whose jobs have been replaced by machines. In addition, family life will continue to be affected by social change. The increasing population of the very young and the very old, the age groups most in need of social work services, is expected to contribute to the demand for social workers. Many openings also will arise because of the need to replace workers who retire, die, or otherwise leave the profession.

Earnings and Working Conditions

According to an early 1971 survey of selected occupations by the Public Personnel Association, the average starting salary paid social caseworkers by various State agencies was about $6,600. This figure, however, reflects very large numbers of persons who do not have a master's degree in social work. Case work supervisors in State agencies had average annual salaries ranging from $8,900 for those having little experience to about $11,300 for those having considerable experience. Salaries of psychiatric social workers averaged from $8,900 to $11,300; those of probation and parole officers averaged from about $7,600 to $9,100.

Salaries of social workers in a cross-section of cities and urban counties were, on the average, above those paid by State agencies. For example, according to the survey cited above, the average starting salary of social case workers in selected urban areas was about $7,700. Salaries of casework supervisors averaged $10,600 for those with little experience to about $13,000 for those with considerable experience. Beginning psychiatric social workers had average salaries of about $10,200, probation and parole officers averaged about $8,500 a year.

In the Federal Government in 1970, graduates of accredited schools of social work received a starting salary of $9,881 a year. Those with 2 years of progressively responsible experience under professional supervision received a Federal Government starting salary of $11,905. Persons having a bachelor's degree or 3 years' experience in technical or investigative work in a welfare activity began at $6,548 and $8,098 a year.

The predominant scheduled workweek for social workers in 1970 was generally 40 hours; however, as many as one-third regularly worked 37½ hours or less a week. In some social work agencies, the nature of the work requires evening and/or weekend work, for which social workers usually receive compensatory time off. Virtually all social work agencies provide fringe benefits such as paid vacations and sick leave and retirement plans.

Sources of Additional Information

Information on admission requirements and scholarship in accredited graduate schools of social work and colleges offering courses in social work, as well as on social work as a career, may be obtained from:

National Association of Social Workers, 2 Park Ave., New York, N.Y. 10016.

SURVEYORS

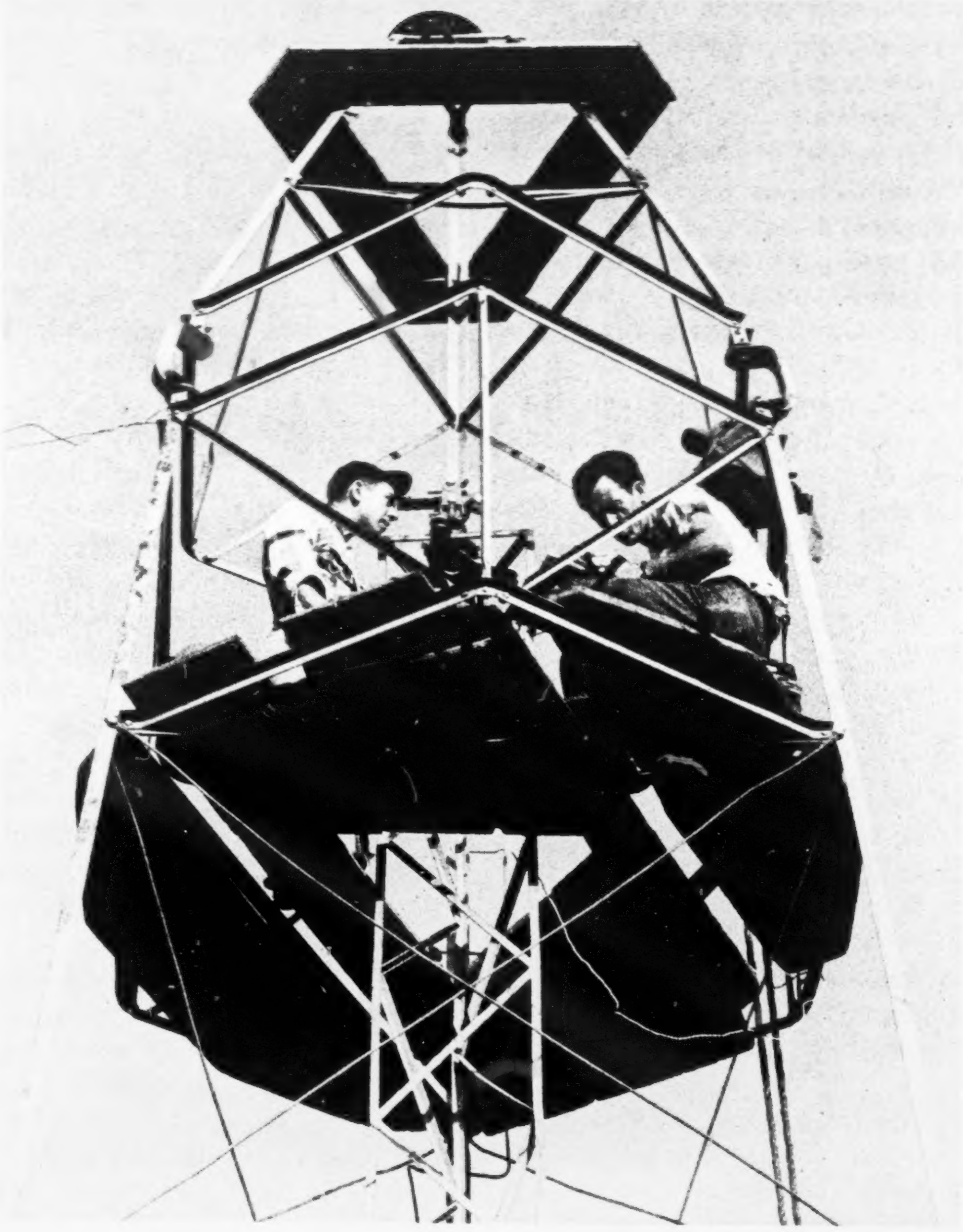
(D.O.T. 018.188)

Nature of the Work

Surveyors play an important part in the construction of highways, airfields, bridges, dams, and other structures, by providing information on measurements and physical characteristics of construction sites. They also locate land boundaries, assist in setting land valuations, and collect information for maps, charts, and plates.

The primary task of the surveyor is to determine the precise measurements and locations of elevations, points, lines, and contours on or near the earth's surface, and the distance between points. The supervisor is directly responsible for the survey and its accuracy. He plans the fieldwork, selects survey reference points, and determines the precise location of natural and man-made features of the survey region. He records information disclosed by the survey; makes mathematical calculations based on such information; verifies the accuracy of survey data; and prepares sketches, maps, and reports.

In making his detailed measurements in the field, the surveyor is assisted by workers in a field party which he directs. A typical field party is made up of three to six members in addition to the surveyor



Surveyors work on triangulation tower.

(sometimes called the party chief). Included in the typical field party are *instrumentmen* who set up, adjust, and operate surveying instruments (including the theodolite, transit, level, altimeter, and electronic measuring devices) at the points designated by the surveyor; *chainmen*, who measure distances between points, using a metal tape or surveyor's chain; and *rodmen*, who use a level rod, stadia board, or range pole to assist in measuring, between selected points, elevations, distance, and directions.

Surveyors often specialize in one particular type of survey. Those doing *highway surveys* are concerned with establishing the points, grades, and lines needed for highway locations. Those performing *land surveys* locate boundaries of a particular tract of land, prepare maps, record plats of the land, and prepare legal descriptions of it for deeds, leases, and other documents. Surveyors doing *topographic surveys* determine the elevations, depressions, and contours of an area, and indicate the location of distinguishing surface features such as farms, buildings, forests, roads, and rivers.

Several closely related occupations are geodesy and photogrammetry. Geodesists measure immense areas of land, sea, or space, taking into account the earth's curvature and its geophysical characteristics. (See statement on geophysicists.) Photogrammetrists apply analytical processes and mathematical techniques to photographs and imagery obtained by aerial or ground surveys to make topographic maps, and to measure and interpret the natural and manmade features of an area.

Places of Employment

It is estimated that about 50,000 surveyors were employed in 1970; less than 5 percent were women. They were located in all parts of the country—in small towns as well as in large cities.

About one-third of all surveyors work for Federal, State, and local government agencies. Among the Federal Government agencies utilizing these workers are the Interior Department's U.S. Geological Survey and Bureau of Land Management, the Army Corps of Engineers, and the Agriculture Department's Forest Service.

Surveyors in State and local government agencies are employed mainly by highway departments and by urban planning and redevelopment agencies.

A large number of surveyors work for construction companies and for engineering and architectural consulting firms. A sizable number either work for surveying firms which conduct surveys on a fee or contract basis or else head such firms. Other significant numbers work for the crude petroleum and natural gas industries and for utilities.

Training, Other Qualifications, and Advancement

The most common method of preparing for work as a surveyor is through a combination of post-secondary school courses in surveying and extensive on-the-job training in survey techniques and in the use of survey instruments. Courses in surveying are offered in extension divisions of many post-secondary schools and by correspondence schools. Some junior colleges, technical institutes, and vocational schools offer 1, 2, and 3-year programs in surveying. The entrance requirement for most surveying programs is high school graduation (preferably including courses in algebra, geometry, trigonometry, calculus, drafting, and mechanical drawing).

For a professional career in photogrammetry, it is usually necessary to obtain a bachelor's degree in engineering or in the physical sciences.

High school graduates having no formal training in surveying also may enter the field, usually starting as rodmen. After several years of on-the-job experience and some formal courses in surveying, young persons may advance successively through the positions of chainman and instrumentman to that of party chief or surveyor.

With some post-secondary school courses in surveying, beginners may start as instrumentmen. In many instances, promotion to higher level positions is based on a written examination as well as on experience.

All 50 States require licensing or registration of land surveyors responsible for locating and describing land boundaries. In some of these States, applicants for licenses are expected to know other types of surveying in addition to land surveying. Requirements vary among the States but in general include a combination of 4 to 8 years' experience in surveying and successful completion of an examination. If an applicant has taken post-secondary school courses related to surveying most States reduce the length of experience needed for licensing. In 1970 approximately 17,000 land surveyors were registered. In addition, about 15,000 engineers were registered to do land surveying, primarily as part of their civil engineering duties; however, these workers are considered engineers rather than surveyors.

In addition to the necessary training and experience, qualifications for success as a surveyor include sound health and a strong liking for outdoor work. Because most surveyors must supervise and direct the work of others, leadership qualities also are important.

Employment Outlook

Employment opportunities for surveyors are expected to be good through the 1970's. It is anticipated that employment in the field will grow rapidly. In addition to new positions, many openings will result each year from the need to replace those who transfer to other occupations, retire, or die. Prospects will be best for people having post-secondary school training in surveying.

Among the factors expected to contribute to the favorable employment outlook is the rapid growth of urban areas, which will create requirements for additional surveyors to locate boundary lines, and to lay out streets, shopping centers, schools, and recreation areas. Construction and improvement of the Nation's roads and highways will also require many new surveyors.

Employment opportunities for women surveyors may be limited, primarily because much of the surveyor's work is strenuous.

Earnings and Working Conditions

In the Federal Government service, in 1970, surveyors employed as field party chiefs received starting salaries of $7,300 or $8,100 a year, depending on experience. The majority of party chiefs earned between $8,000 and $11,000 per year, whereas some surveyors in high level positions earned more than $12,000. In private industry, according to the limited data available, salaries for surveyors were generally comparable to those offered by the Federal Government but varied somewhat between different areas of the country.

Surveyors usually work an 8-hour day and 5-day week. However, they sometimes work longer hours during the summer months when weather conditions are most suitable for surveying activities.

The work of surveyors is active and sometimes strenuous. They may stand for long periods. They may also walk long distances or climb mountains with heavy packs of instruments and equipment. Because most of their work is done out of doors, surveyors may be exposed to all types of weather conditions. Some duties, such as planning surveys, preparing reports and computations, and drawing maps usually are performed in an office.

Sources of Additional Information

Specific questions concerning training and career opportunities in surveying may be directed to:

American Congress on Surveying and Mapping, Woodward Building, 733 15th St. NW., Washington, D.C. 20005.

General information on careers in photogrammetry may be obtained from:

American Society of Photogrammetry, 105 North Virginia Ave., Falls Church, Va. 22046.

URBAN PLANNERS

(D.O.T. 199.168)

Nature of the Work

Urban planners develop comprehensive plans and programs for the growth and overall revitalization of urban communities. They attempt to remedy urban problems such as deteriorating business and residential areas, traffic congestion, inadequate parks and recreation facilities, shortages of suitable space for industrial development, and air pollution.

In addition, the growth of the suburbs has added increased pressure on the urban center to provide more and better transportation and parking facilities. Urban planners visualize future conditions in the light of trends in population growth and social and economic change; they also estimate the community's long-range needs for land, housing, community facilities, transportation, recreation, business, and industry. The urban planner analyzes alternatives and proposes methods for achieving an efficient and attractive community within a framework determined by the community's governing body.

Before they can produce plans for long-range community development, however, urban planners must make detailed studies, including the preparation of maps and charts, which show the current use of land for residential, business, and community purposes; the arrangement of streets, highways, and water and sewer lines; and the location of such community facilities as schools, libraries, and playgrounds. These studies also provide information on the types of industry in the community, population densities and characteristics, social features, income levels, employment and economic trends, and other related information.

After they have analyzed and evaluated the facts, urban planners design the layout of recommended facilities and land use and supervise the preparation of illustrative materials. They also prepare plans to show how their proposed programs can best be carried out and what the cost is likely to be. Much of their time is spent conferring with private land developers, civic leaders, and officials of public agencies who do specialized planning. They also may prepare materials for community relations programs, speak at civic meetings, and appear before legislative councils and committees to explain and defend their recommendations or proposals.

In small planning organizations, planners must be able to handle several kinds of work. In large organizations, which may have several dozen planners, each may specialize in an area such as physical design, survey and research, or community relations work. Some specialize in

Urban planners discuss community renewal plans.

new town planning, the rehabilitation of city slum areas, or the reconstruction of rundown business districts.

Places of Employment

About 8,000 people were employed as professional urban planners in 1970. The majority of urban planners are employed by governmental agencies, mainly city, county, and metropolitan regional planning organizations; a growing number are employed by various State governments and by the Federal Government. About one-fifth of the planners do consulting work, either independently in addition to their full-time job, or as an employee or partner in a private consulting firm providing services for private developers or for government agencies. Urban planners also work for large land developers or private research organizations and teach in colleges or universities.

Training, Other Qualifications, and Advancement

Employers consider a master's degree in planning the most desirable educational background for professional work in this field. In Federal agencies and in a growing number of other government agencies, 2 years of graduate work in city planning, or its equivalent, are required for most entrance level positions. However, young people having bachelor's degrees in city planning, architecture, landscape architecture, engineering, public administration, and some other social science fields also may qualify for entrance level positions.

In 1970, more than 50 colleges and universities awarded the master's degree in urban planning. For entrance into the programs, most schools require that students have undergraduate degrees in fields such as architecture, landscape architecture, engineering, economics, statistics, sociology, public administration, or city and regional planning. Nearly all schools require students to spend considerable time in workshop, laboratory, or studio courses, learning to analyze and solve practical problems in urban planning. Most schools require candidates for the master's degree to take 2 years of graduate work and to prepare a thesis or take a final comprehensive examination. A few schools have recently adopted a 3-year master's degree program. Nearly half of the schools require some practical experience or internship. This latter requirement is usually fulfilled by regular paid employment during summer months in a planning office approved by the school's faculty. A very few schools which stress physical design grant a master's degree on completion of 1 year of graduate work to students who hold a bachelor's degree in architecture or engineering.

Planners must have the ability to think in terms of spatial relationships and to visualize the effects of their plans and designs.

Planners also must be able to cooperate with others, since they sometimes encounter differing attitudes and viewpoints which must be evaluated and accepted or rejected with tact to achieve the desired goal. On occasion, they face the discouragement of seeing carefully designed plans fall through because of conflicting political interests or apathy.

Beginners in urban planning offices are likely to spend some time doing routine work or making field surveys and compiling statistics required to make projections for future plans. As they become more experienced, workers may be assigned to outline proposed studies, write reports, design the physical layout of a large development, make statistical analyses and projections, or perform other duties which require a high degree of independent judgment. Senior planners and planning directors are likely to spend much time meeting with officials in other organizations, addressing civic groups, and supervising other professionals. Advancement often occurs through a transfer to a larger city, where the problems are more complex and the responsibilities are greater.

Candidates for the position of urban planner in Federal, State, and local government agencies frequently must pass civil service examinations to become eligible for appointment. These examinations are often advertised nationally and usually do not impose residence restrictions.

Employment Outlook

Employment opportunities for graduates having professional training in city and regional planning are expected to continue to be very good through the 1970's. Shortages of qualified planners have been reported in rècent years, even though the number of graduates has been rising. In 1970, the American Society of Planning Officials estimated that there were about 1,300 vacancies in planning agencies because of the shortage of well-qualified planners. Although most openings will stem from new positions, some also will result from the need to replace planners who transfer to other fields of work, retire, die, or leave the field for other reasons.

This profession is expected to grow through the 1970's as more communities turn to professional planners for help in determining the most effective way to meet the rising requirements for physical facilities that result from urbanization and growth in population. As urban communities continue to spill into neighboring areas or merge with other urban areas, open spaces for recreation disappear, smog and traffic problems multiply, and the need for more and better planned facilities becomes acute.

The construction of new cities and towns also is expected to contribute to a rising need for planners. In addition, Federal assistance to communities for urban planning, slum clearance and urban renewal, and beautification and open space land improvement will continue to stimulate the demand for planners. Although many openings will be with the government, more and more private enterprises are employing urban planners.

Earnings and Working Conditions

Starting salaries of inexperienced planners having only a bachelor's degree were between $8,300 and $11,300 a year in 1970. Starting salaries for persons having a master's degree were generally higher, ranging from $9,300 to $12,300 a year. Planners having a master's degree and 2 to 5 years experience earned annual salaries of between $9,500 and $16,500 or more. Salaries of Directors of Planning depend to a great extent on the size of the city in which they are employed. In 1970, the average annual salary for a Planning Director in a city having between 10,000 and 25,000 people was $12,500. In cities of over 250,000 people, the average annual salary of Planning Directors was $22,000. Consultants are generally paid on a fee basis. Their earnings are often high and vary greatly according to their reputation and previous experience.

In 1970, the usual entrance salary for urban planners employed by the Federal Government was $9,881 a year. In a few cases, depending upon their academic records, individuals having less than 2 years of graduate work or its equivalent were hired as interns at yearly salaries of $6,548 or $8,098.

Since most planners work for government agencies, they usually have sick leave and vacation privileges, and are covered by retirement and health plans. Although most city planners have a scheduled workweek of 40 hours, they sometimes work in the evenings and on weekends because of the need to attend meetings with citizen's groups.

Sources of Additional Information

Additional information on planning and a list of schools offering training may be obtained from:

American Institute of Planners, 917 15th St., NW., Washington, D.C. 20005.

American Society of Planning Officials, 1313 East 60th St., Chicago, Ill. 60637.

MANAGERIAL OCCUPATIONS

The success or failure of business enterprises depends heavily on the way managers do their job. More than 6 million salaried workers—85 percent of them men—were employed in 1970 to manage the Nation's business enterprises. An additional 2.2 million managed all or part of their own businesses. Salaried business managers, one of the fastest growing occupational groups in the country, increased nearly four times as fast as all workers between 1960 and 1970. (See chart 18.)

This chapter describes salaried managers as a group and presents individual statements on three such occupations—city managers, industrial traffic managers, and purchasing agents. Statements on other occupations that frequently involve managerial functions are presented in the Business Administration and Related Professions section of the *Handbook*.

Nature of the Work

A manager's responsibilities depend on his level of management and type of employer. Although salaried managers direct or plan the work of others, some are chiefly policymakers.

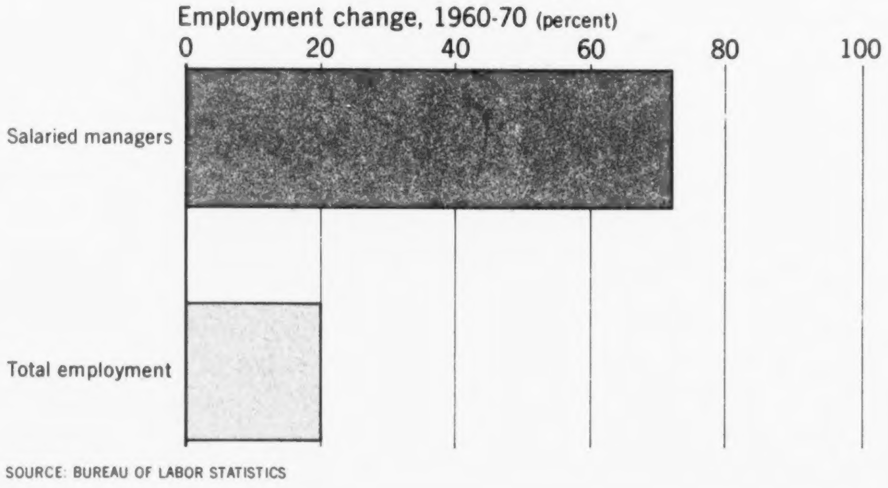
Entry-level management positions are either supervisory or trainee. Supervisors, the largest group, direct workers in activities such as sales, production, accounting, and purchasing. A department manager in a retail department store, for example, has a typical supervisory job. Responsible for merchandising in one department or more, he may supervise as many as 50 employees. Manager trainees are sometimes assigned to assist managers; or they may be placed in a number of different jobs for short periods to learn several phases of the business.

Higher in the managerial pyramid are the middle-level managers; they have the top posts in large and important departments such as sales, accounting, research and development, marketing, production, purchasing, data processing, and personnel. When faced with nonroutine business problems, they must make decisions promptly within the framework of company policy. For example, the manager of a manufacturing company's engineering department may (1) oversee the development of new products; (2) develop plans for making efficient use of the firm's space and facilities; (3) set up and manage support services such as equipment maintenance.

Top level managers make major decisions such as the goods their firms will produce, locations of new plants, or methods of financing new projects. This top group includes the board of directors, chairman of the board of directors, president, and vice presidents. Each vice president is a policymaker and administrator for one or more company departments (for example, finance, marketing, or production) and reports directly to the president. The president or chairman of the board has final responsibility for the company's success. He usually presides at meetings and confers with officers on policy matters and problems in their individual areas.

Management responsibilities in government are similar to those in private industry. However, public service is a major responsibility of many managers in government.

⑱ Employment of salaried managers is growing much faster than total employment



SOURCE: BUREAU OF LABOR STATISTICS

Places of Employment

Although managers are employed throughout industry, more are required in some industries than in others. For example, in 1970, nearly one-third of all salaried managers worked in retail and wholesale trade. About one-fifth had jobs in manufacturing firms. Considerable numbers also worked in finance, insurance, real estate, service, transportation, and Government. Women find their best opportunities in retail trade; one-third of all women managers are employed in this field.

Training

Employers increasingly require beginning managers to have completed college. Although a person who doesn't have a degree may work his way up through the ranks, his promotional opportunities are becoming limited.

For beginning management jobs, many employers look for individuals who have a college degree in business administration, with a major in accounting, economics, or finance. Other employers look for applicants who have technical training in engineering, science, or mathematics to deal with complex industrial processes. Still others hire liberal arts graduates and give them training on the job.

The number of companies that have formal management trainee programs is relatively small. As a result, entrance to many management jobs comes after several years of progressively more responsible work experience in jobs such as salesman or accountant.

The climb up the promotional ladder may be in one area of work, such as personnel, or in several areas, such as shifts from sales to marketing, or finance. Managerial skills usually can be applied as effectively in one firm or industry as another. For this reason, managers are able to change jobs with relative ease.

To increase their knowledge of management techniques, many experienced managers take advantage of training programs given by colleges and universities, companies, and various professional and trade organizations. For example, management associations conduct educational programs for experienced managers ranging from lectures and workshops of a few days duration to formal classroom courses lasting several weeks. These educational activities usually are led by experienced businessmen.

Employment Outlook

New career opportunities for managers are expected to increase moderately through the 1970's; moreover, many thousands of openings are likely to occur annually as managers retire, die, or leave the field for other reasons. The business world will need more managers as industry continues to expand, spurred by a growing population, rising living standards, and an increasing demand for goods and services. The employment of salaried managers is likely to continue to increase rapidly because large firms tend to depend more on trained management specialists as they further increase in size. Their problems of control and communication, their need for specialized services, and their complex machinery demand a higher ratio of managers to total employees than is required by smaller firms. Similar influences also will necessitate more managers in government agencies.

Earnings and Working Conditions

In 1970, starting salaries in private industry for management trainees having bachelor's degrees generally ranged from $7,500 to $10,500 a year. Trainees having master's degrees generally began at $10,800 to $14,000 a year.

In the Federal Government, management trainees usually began at $8,098 in 1970. New employees who had a master's degree or were well qualified entered managerial work at $9,881 a year.

At higher management levels, salaries are related to company size, scope of the job, and nature of the industry. Middle-management salaries ranged from $10,000 to $35,000 a year in 1970. Very large companies paid up to $50,000 a year for some middle-management positions. Earnings of the chief executive averaged about $45,000 a year in small companies but as high as $200,000 or more in large corporations.

In addition to their salaries, management officials receive other compensation, such as bonuses, stock options, and participation in profit sharing plans. Such additional compensation depends to a considerable extent on a company's profits. Bonuses are a common type of extra compensation and generally average about 30 percent of a top executive's earnings. Many companies also provide liberal life insurance, health benefits, club memberships, and various special privileges according to the individual's position in the firm. Social prestige attained in the upper business levels also may be rewarding.

Entry-level managers usually work the standard workweek of the company—from 35 to 40 hours. Managers in more responsible positions carry heavier workloads and may work longer hours. Nonroutine assignments carried out on their own time may involve travel, nightwork, speaking engagements, and other activities.

Sources of Additional Information

The American Management Association, 135 West 50th St., New York, N.Y. 10020.

Society for Advancement of Management, 1412 Broadway, New York, N.Y. 10036.

CITY MANAGERS

(D.O.T. 188.118)

Nature of the Work

The country's growing population and expanding industry are placing increased pressures on the housing, transportation, recreational, and other facilities of our Nation's cities. Other problems associated with growing modern communities such as air and water pollution, and rising crime rates also demand attention. Coping with these problems effectively requires sophisticated management techniques. Thus, communities are turning to a specialist having such skills—the city manager.

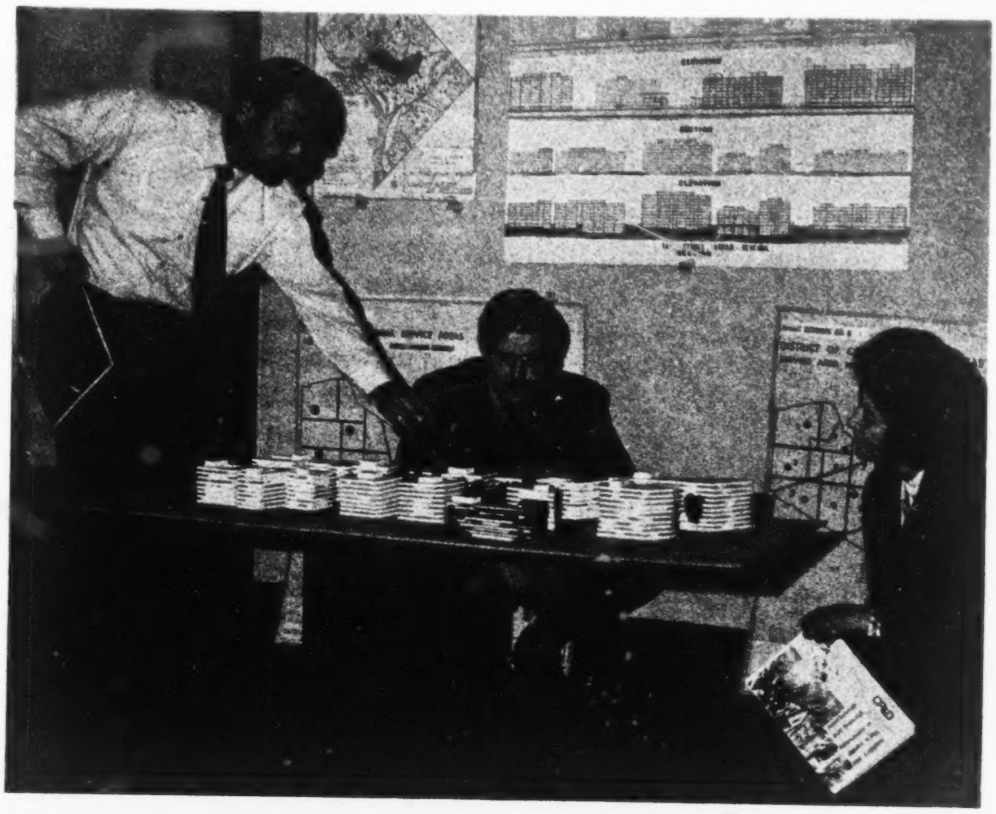
The city manager is appointed by the community's elected officials and is directly responsible to the appointing body. The city manager's duties vary by city size, but generally include appointing department heads and their staffs; coordinating and administering the activities of the operating departments such as tax collection and disbursement, law enforcement, and public works; and preparing the annual budget for the council's approval. They also study problem areas such as unionization of government employees and urban renewal and report their findings to the council, identifying alternate solutions. City managers plan for future development of cities and the surrounding areas to provide for population growth and expansion of public services. They also frequently appear at civic meetings to advocate proposed programs or to inform citizens of current government operations.

City managers keep in close communication with the planning department to coordinate the introduction of new programs with the operations of existing ones. In smaller cities which have no permanent planning staff, that duty may be assumed entirely by the manager.

Support personnel, such as the assistant city manager, administrative assistants, and department head assistants, operate under direction of the city manager. Assistant city managers relieve the city manager of routine duties and act for him in his absence. In addition, they may assume responsibility for some projects, such as developing a preliminary annual budget. Department head assistants generally are responsible for one activity, such as personnel, finance, or law, but also may assist in other areas. Administrative assistants, also called executive assistants or assistants to the city manager, usually perform administrative and staff work. The efforts of administrative assistants are not concentrated in one area, but are utilized in all departments at the direction of the city manager. For instance, they may compile operating statistics, review and analyze work procedures, and answer public inquiries.

Places of Employment

An estimated 2,600 city managers were employed in the United States in 1970. An additional three to four thousand persons were em-



City manager discusses urban renewal project with staff.

ployed as support personnel. About four-fifths of all city managers worked in cities which have a council-manager form of government. Most of the remainder were employed in municipalities which have another form of government such as mayor-council government in which the city manager is appointed by the mayor, and called "administrative assistant." A small number of managers are employed by metropolitan or regional planning organizations.

Over one-half of the cities which had a population of 10,000 to 500,000 had a city manager. Some city managers also worked for county governments. Although city managers are employed in 48 of the 50 States, nearly 45 percent are located in California, Maine, Michigan, Pennsylvania, and Texas.

Training, Other Qualifications, and Advancement

The minimum educational background needed for entrance into this profession is a bachelor's degree, preferably with a major concentration in political science or public administration. However, a master's degree in public or municipal administration is preferred.

In 1970, about 200 colleges and universities offered a master's degree program in public or municipal administration. Degree requirements in some schools include successful completion of an internship program in a city manager's office. During this internship period, which may last from 6 months to a year, the degree candidate observes government operations and performs research work under direct supervision of the city manager.

Some new graduates from bachelor's or master's degree programs enter the occupation by taking manager positions in small towns and then seek positions in large cities as they gain experience. However, some new graduates desire positions as interns or lower level assistants in large cities. Larger cities offer greater opportunities for experience in a wider range of problem-solving areas such as freeway planning, urban renewal, and crime control.

As the young professional gains additional skills and competence, he may advance to a position of greater responsibility such as department head assistant. In this position, he may gain the supervisory and planning skills necessary to oversee an entire department. Administrative experience in the departments of finance, public works, or public planning also may provide the necessary skills and experience for advancement to manager.

Certain personal qualifications or traits enhance the city manager's chances of success. He must be dedicated to public service, since he often must put in long hard hours in times of crises. Another important personal quality is the ability to understand and work well with people. The city manager, because he is the most accessible of government officials, must be able to satisfactorily deal with citizen's complaints and maintain good working relationships with his fellow officials.

Other desirable traits include: communication skills, sound judgment, tact, self-confidence, and the ability to perform well under stress.

The city manager may be called upon at any time to solve emergency situations and he must be able to quickly isolate the problem areas, identify the underlying causes, and provide alternate solutions.

Employment Outlook

Employment opportunities for city managers are expected to be excellent through the 1970's, especially for persons having a master's degree in public or municipal administration. In addition to openings resulting from the need to fill new positions, many openings will arise each year from the need to replace city managers who retire, die, or transfer to other fields of work.

The employment of city managers is expected to increase very rapidly through the 1970's as methods for dealing with the problems of our growing cities become more complex. Examples of this complexity are computerized data collection of police information, advances in technology of traffic control, and the application of systems analysis to urban problems.

The need for city managers is expected to increase as cities convert to the council-manager form of government, currently the fastest growing form of local government. City managers also will be needed in places having other forms of government. Elected officials are expected to rely increasingly upon the city manager's skills to cope with the day-to-day operations of government.

Earnings and Working Conditions

Salaries of city managers and their assistants vary according to the amount and type of education and experience as well as job responsibility and size of city. The average salary earned by persons in beginning positions was about $7,500 in 1970 according to the International City Management Association. This figure is somewhat lower than starting salaries in business and industry, according to survey reports. Salaries, however, generally tend to be lower in government, especially local government.

In 1970, the median salary for city managers varied from about $17,000 in cities of 10,000 to 25,000 inhabitants, to about $34,000 in cities with 250,000 inhabitants or more. Assistant city managers earned median salaries of over $14,000 a year.

A workweek of longer than 40 hours is common for most city managers. This may include work on weekends and evenings to settle emergency problems that may arise. Meetings with individuals and citizen's groups consume additional time.

Fringe benefits usually include health and life insurance programs, pension plans, sick leave, vacation benefits, and often the availability of a car for official business. Managers generally are reimbursed for expenses incurred while attending professional meetings and seminars.

Sources of Additional Information

International City Management Association, 1140 Connecticut Ave. NW. Washington, D.C. 20036.

INDUSTRIAL TRAFFIC MANAGERS

(D.O.T. 184.168)

Nature of the Work

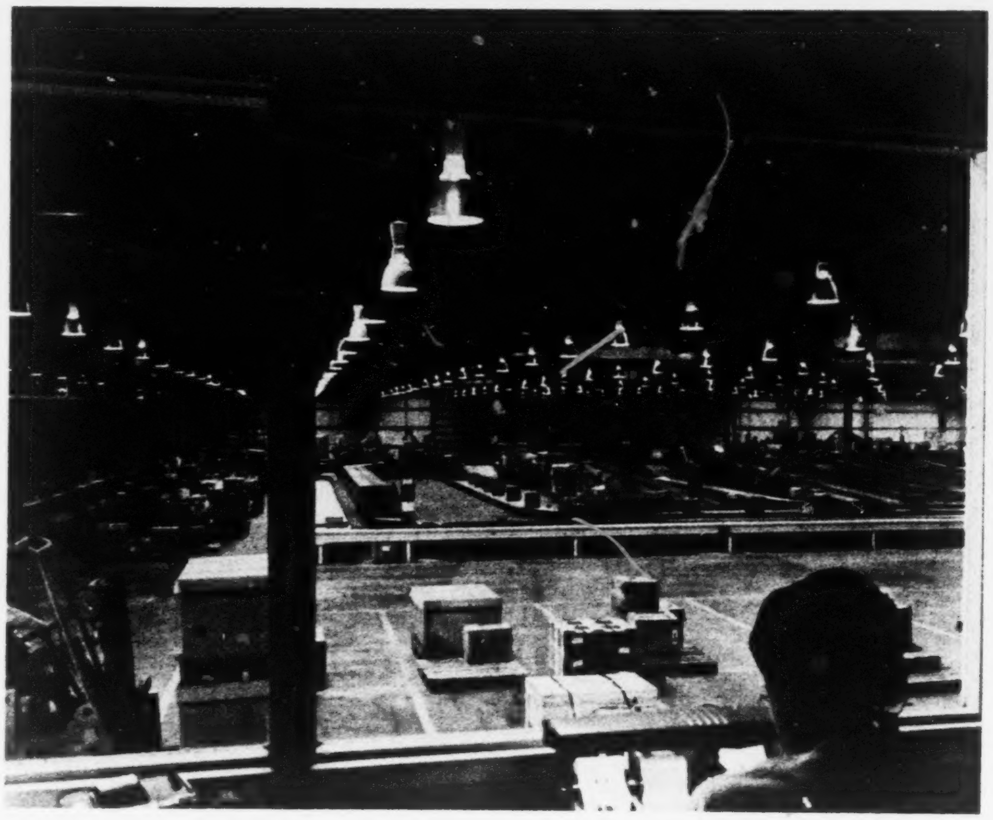
Industrial traffic managers and their assistants arrange transportation of raw materials and finished products for industrial firms.

After analyzing various transportation possibilities, industrial traffic managers choose the most efficient type of transportation—rail, air, road, water, pipeline, or some combination—the route and the particular carrier. They must consider factors such as freight classifications, rates, routes, and regulations; company time schedules; size of shipment; and loss and damage rates. This statement does not cover traffic managers employed by railroads, airlines, trucking firms, and other freight carriers who are chiefly concerned with attracting business to their firms.

Activities of industrial traffic managers range from routine checking of freight bills to major planning and policymaking. For example, they decide whether the company should buy and operate its own fleet of trucks. They route and trace shipments, arrange with carriers for transportation services, prepare bills of lading and other shipping documents, and handle claims for lost or damaged goods. Traffic managers maintain records of shipments, freight rates, commodity classifications, and applicable government regulations. Industrial traffic managers also must know about changing transportation concepts, such as piggyback freight or containerization.

Sometimes traffic managers are responsible for the packaging of shipments and for their companies' warehouse facilities and transportation equipment.

Since many aspects of transportation are subject to Federal, State, and local government regulations, traffic managers must know about these and any other legal matters that apply to their companies' shipping operations. High level traffic managers represent their companies before rate-making and regulatory bodies—such as the Interstate Commerce Commission, State Commissions, and local traffic bureaus.



Places of Employment

In 1970, most of the over 18,000 industrial traffic managers were employed by manufacturing firms; some worked for stores. A few were consultants in business for themselves or for firms that handle transportation problems for clients. Most traffic managers are men.

Training, Other Qualifications, and Advancement

Although persons having only a high school education can qualify for a traffic manager position on the basis of experience in traffic departments, a college education is becoming increasingly important for a career in this field. For some kinds of work, college training may be required. For example, in order to argue cases before the U.S. Government's Interstate Commerce Commission, a traffic manager must meet certain "qualification standards" which include at least 2 years of college. Some employers prefer graduates having a degree in traffic management, which is available at more than 100 colleges, universities, and junior colleges. Others prefer liberal arts majors who have had courses in transportation, management, economics, statistics, marketing, or commercial law.

New traffic department employees often complete shipping forms and calculate freight charges in shipping rooms or general traffic offices. After gaining routine experience, they may perform more technical work, such as analyzing transportation statistics. A competent worker may advance to a supervisory position, such as supervisor of rates and routes. The most competent may be promoted to assistant general traffic manager and eventually to general traffic manager.

Workers in traffic departments may advance by participating in company-sponsored training programs, taking courses in colleges and universities or schools specializing in traffic management, or attending seminars sponsored by private organizations. "Certified" membership in the American Society of Traffic and Transportation, Inc. can be acquired by successfully completing the Society's four examinations and meeting certain education and experience requirements. College credit may be substituted for three of the four examinations.

Employment Outlook

A moderate increase in employment in this occupation is expected through the 1970's. Many new industrial traffic manager positions will be created as corporations reorganize their shipping and receiving activities into separate traffic departments to centrally control their transportation functions.

Other factors expected to contribute to growth in this field are the increasing emphasis in many industries on efficient management of transportation activities, and the trend toward procuring raw materials and finished products from more distant places and distributing them to increasingly wider markets. As more companies realize that transportation costs can vary widely, they will become more concerned with the economics of shipping. Thus, a strong demand is expected for specialists who know how to classify products so as to obtain the lowest possible freight rates, or choose the carriers that are best able to handle each shipment, and otherwise protect their companies from excessive shipping expenses.

Earnings and Working Conditions

Young men having college degrees who started as business trainees in the traffic departments of large industrial firms often received annual salaries of more than $8,000 in 1970 according to the limited data available. Beginners having less schooling, however, usually received lower salaries.

Earnings of experienced traffic managers are related generally to their companies' sales volume and transportation costs. The average (median) salary of traffic managers in companies with transportation costs totaling less than $1 million annually was about $15,000 in 1970 according to the limited information available. In companies where transportation costs ranged between $4 million and $10 million, annual salaries ranged between $25,000 and $30,000. In firms whose costs were still higher, some traffic executives earned $40,000 or more a year.

Traffic department employees usually work the standard workweek of their companies—generally from 35 to 40 hours. Those in particularly responsible jobs may have to spend some time outside regular working hours preparing reports, attending meetings, and traveling to hearings before State and Federal regulatory agencies.

Sources of Additional Information

For information on the requirements for certification write to:

American Society of Traffic and Transportation, Inc., 22 West Madison St., Chicago, Ill. 60602.

PURCHASING AGENTS

(D.O.T. 162.158)

Nature of the Work

Purchasing agents buy the materials, supplies, and equipment needed for their employer's firms to function. Purchasing agents and their assistants have two main responsibilities: Obtaining goods and services at the lowest cost consistent with required quality and seeing that adequate supplies are kept on hand. What the agents buy depends on the kind of organization employing them. For manufacturing firms, this may be largely machinery, raw materials, and product components; for government agencies, it may be office supplies, office furniture, and business machines.

A purchasing agent buys either when stocks on hand reach a predetermined re-order point or when he receives a requisition from a department in the organization for items it needs. These requisitions list and describe needed items and include information such as required quantities and delivery dates. Since the agent usually can purchase from many sources, his main job is to select the seller who offers the best value. To do this, the agent must consider many factors, such as the exact specifications for the required items, price, quality, quantity discounts, transportation cost, and delivery time.

To select among suppliers, the purchasing agent uses a variety of means. He obtains information by comparing listings in catalogs and trade journals and by telephoning various suppliers. He also meets with salesmen to examine sample goods, watch demonstrations of equipment, and discuss items to be purchased. Sometimes, the agent also invites suppliers to bid on large orders, and then selects the lowest bidder who meets the requirements regarding the specifications established for the goods and date of delivery.

It is important for purchasing agents to develop good working relations with their suppliers. These relations can result in savings on purchases, favorable terms of payment, and quick delivery on rush orders or material in short supply. They also work closely with personnel in various departments of their own company. For example, they frequently discuss product specifications with company engineers or shipment handling problems with employees in the shipping and receiving, storage, or traffic departments.

Purchasing agent discusses specifications of items with salesman.

Once an order has been placed with a supplier, the purchasing agent makes periodic checks to insure that it will be delivered on time. This is important in preventing interruptions in the work flow due to lack of materials. After an order has been received and inspected, the purchasing agent authorizes payment to the shipper.

Because of its importance, purchasing usually is designated as a separate responsibility. Although the head of the purchasing department usually is called a purchasing agent, he may have the title of vice president-purchasing, procurement or purchasing officer, director or manager of purchasing, or buyer. ("Buyers" in retail stores and others who are engaged in buying merchandise for resale in its original form are not included in this report.) In a large firm, the head of the purchasing department directs the work of a staff including assistant purchasing agents and clerical workers. Each purchasing assistant may be assigned to a broad area. One person may be responsible for buying raw materials; another, factory machinery; and another, office supplies. Others may specialize in buying certain items—for example, steel, lumber, cotton, or oil.

Places of Employment

In 1970, half of the estimated 167,000 purchasing agents in the United States worked in manufacturing industries. Large numbers also were employed in government agencies, wholesale and retail trade, and service institutions.

Most purchasing agents work in firms that have fewer than 10 employees in the purchasing department. Some large firms, however, may have a hundred specialized buyers or more. About 90 percent of all purchasing agents are men.

Training, Other Qualifications, and Advancement

For beginning positions as purchasing agents, many employers prefer to hire graduates of schools of business administration or engineering who have had courses in accounting, economics, and purchasing. A few require graduate training in business administration. On the other hand, many firms prefer experience with the company and select purchasing workers from among their own personnel, whether or not they have a college education. For advancement to high-level positions, however, a college degree is becoming increasingly important.

Regardless of previous training, the beginner in the purchasing field must spend considerable time learning about his company's operations and purchasing procedures. Some companies provide classroom instruction and on-the-job training. The beginner may be assigned to the storekeeper's section to learn about operations such as keeping inventory records, filling out forms for the purchase of goods, or providing proper storage facilities. He then may work with an experienced buyer to learn about types of goods purchased, prices, and sources of supply. Following the initial training period, the trainee may become a junior buyer of standard catalog items. As he gains experience and exercises good judgment in the various aspects of purchasing he may be promoted to assistant purchasing agent and then to purchasing agent. In large companies, purchasing agents or heads of purchasing departments may become vice presidents with overall responsibility for purchasing, warehousing, traffic, and related functions.

The purchasing agent must be able to accept the responsibility of spending large amounts of company money. He must also be tactful in his many dealings with salesmen and have a good memory for specifications.

Employment Outlook

Opportunities are expected to be good through the 1970's for young people to enter and advance in purchasing occupations. Demand is expected to be especially strong for graduates of schools of business administration who have taken courses in purchasing. Demand is expected to be excellent also for graduates having backgrounds in engineering and science, for jobs in purchasing departments of firms that manufacture complex machinery, chemicals, and other technical products. Liberal arts college graduates should be able to obtain trainee positions in many types of firms. On the other hand, although outstanding persons who do not have a college education will continue to be promoted to purchasing from clerical, sales, and other types of jobs, their opportunities for advancement to high-level purchasing jobs will be limited.

Employment of purchasing agents and their assistants is expected to grow moderately through the 1970's. Some major factors underlying this expected growth are the continuing increase in the size of business and manufacturing firms, the development of new products and new sources of supply (including foreign markets), and the ever-increasing complexity and specialization of business functions. Competition among manufacturers for new, improved, and less costly goods, raw materials, and services will further direct the attention of top management to the importance of purchasing functions. In addition to job openings resulting from growth, many job opportunities are expected annually because of the need to replace personnel who retire, transfer to other jobs, or leave the field for other reasons.

Earnings and Working Conditions

Beginning annual salaries of college graduates hired as trainees in purchasing departments of large private firms ranged from $6,300 to $7,500 in 1970, according to the limited data available. In the Federal Government, beginning purchasing agents who had college degrees started at $6,548 or $8,093 in 1970, depending on the individual's scholastic achievement and his performance on the Federal Civil Service entrance examination.

In 1970, the annual earnings of experienced buyers in private firms averaged more than $9,000; more experienced buyers, some having supervisory duties, averaged nearly $14,000. Some top purchasing executives earned between $35,000 and $75,000 a year.

CLERICAL AND RELATED OCCUPATIONS

More than 13 million people were employed in clerical and related work in 1970. A great many of these workers keep records and do other paperwork required in offices. Others handle communications, operate office machines of all types, attend to the shipping and receiving of merchandise, ring up sales on the cash registers of stores and restaurants, or do related work.

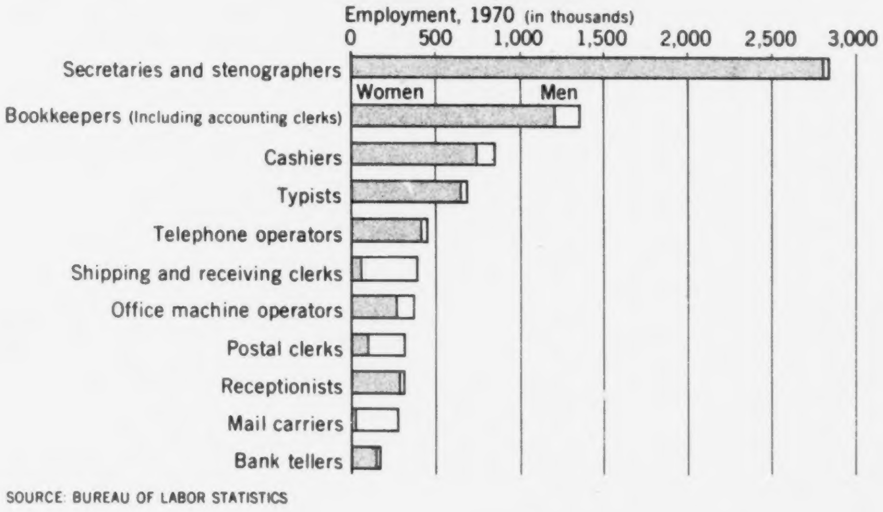
Clerical workers represent a wide variety of skills and experience. Included, for example, are highly skilled title searchers and examiners in real estate firms and executive secretaries in business offices, as well as workers in occupations which can be entered with little specialized training or experience—messengers, file clerks, and others. For women, clerical occupations are particularly important in terms of numbers employed. More than half of all girls who go to work after completing high school find jobs in clerical and related occupations. Also, 7 out of 10 clerical workers are women.

By far the largest single group of clerical workers—1 out of 5—work as secretaries or stenographers. Bookkeepers and accounting clerks, who represent a little less than one-tenth of the total, make up the next largest group. Chart 19 shows employment in these and in other major clerical occupations discussed in this chapter or elsewhere in the *Handbook*.

Training, Other Qualifications, and Advancement

For all but the most routine clerical positions, the minimum educational requirement is usually graduation from high school. High school graduates who have had instruction in business subjects are regarded by most employers as particularly well qualified. Some companies cooperate with local high schools and business schools in office education programs which provide opportunities for students to work part time, under trained supervision, while still attending school. This experience is useful to beginners seeking office jobs after graduation. The Federal Government also sponsors training for some clerical occupations under provisions of the Manpower Development and Training Act.

⑲ The majority of clerical workers are employed in these occupations



SOURCE: BUREAU OF LABOR STATISTICS

Qualifications for many types of clerical work include reading comprehension, a knowledge of spelling and grammar, and ability in arithmetic. Some employers test applicants for clerical aptitude to determine their qualifications for work in this field.

Practically all beginning clerical workers receive some on-the-job training. They learn, for example, how their employer keeps the firm's records, and what kinds of business forms are used. They also may learn to operate adding and duplicating machines and other equipment which they will use occasionally. If they are to operate tabulating machines or other specialized equipment, their employers may have them attend a school to receive the necessary training.

Advancement prospects are good in many types of clerical work. Some of the better paid positions —insurance claim adjuster and executive secretary, for example—require a general knowledge of company policies and procedures, and very often are filled by promotion from within. In other instances, the worker may be promoted to more difficult and higher paid assignments in a related type of work. For example, a keypunch operator is selected and trained to operate a tabulating machine. In large business offices, promotion sometimes may lead to supervisory or managerial positions.

Experience within an organization is often an important consideration in selecting employees for promotion. Emphasis also is placed on the individual's learning ability and personal qualifications. For workers without a good educational background, opportunities for advancement are likely to be limited. Many people in clerical occupations are high school graduates who have had some additional education in colleges, junior colleges, private business schools, or other post-secondary institutions. Some are college graduates who start as office workers to gain experience which will later qualify them for professional or administrative positions.

Employment Outlook

Employment in clerical occupations is expected to increase rapidly through the 1970's. As employment rises to meet the needs of an expanding economy, more than 350,000 new clerical and related positions will be added each year. An even greater number of clerical workers will be needed each year to replace those who retire or leave their jobs for other reasons. Employee turnover is especially high among clerical workers because many of the women who do this kind of work leave their jobs to care for their families.

Employment opportunities will be best for secretaries and stenographers, typists, bookkeeping and accounting clerks, and other workers who handle paperwork in offices. These workers will be needed particularly in banks and insurance companies; in manufacturing establishments and in wholesale and retail trade; and in government offices, educational institutions, and professional service organizations.

The growth in the number of clerical workers is expected to result primarily from the increasing amount of paperwork which will accompany the growth of large and complex organizations. However, more and more mechanical equipment will speed the process of keeping business records, and in some offices, the number of clerical employees may be reduced. For the economy as a whole, however, the new positions created by growth are expected to far outnumber the clerical jobs eliminated by mechanization. Furthermore, many types of clerical workers are in jobs unlikely to be materially affected by mechanization—for example, secretaries, receptionists, persons responsible for collecting bills and handling complaints, and others whose duties bring them into contact with the public and require them to exercise initiative and judgment.

Nevertheless, the increased use of computers and other mechanical devices to process routine, repetitive work will probably restrict growth in the number of clerks employed to prepare payrolls, keep inventories, sort checks in banks, and do other routine work. As work of this kind is transferred from clerks to machines, new positions for various kinds of machine operators will be created. This shift in type of clerical personnel will occur chiefly in large business firms and in the metropolitan areas where such firms tend to be concentrated.

Earnings and Working Conditions

The average salaries of women office workers in metropolitan areas surveyed by the Bureau of Labor Statistics in 1968–69 ranged from about $70 a week for file clerks doing the most routine kind of work to nearly $160 a week for skilled secretaries. Within each of the office occupations, the differences in the salaries paid some individuals were considerable; for example, a few payroll clerks earned less than $60 a week; a few others whose work was complex earned $190 or more.

Men generally were paid higher salaries than women employed in the same localities. For example, the average for office boys was $5 a week more than for office girls, and men employed as accounting clerks averaged about $20 a week more than women in the same kinds of jobs. To some extent, these variations were due to differences in the industries where employed. Minor differences in the duties and responsibilities assigned to men and women also may affect the pay level.

Office employees worked a 40-hour week in most of the cities included in the survey. In some, especially in the northeastern part of the country, the scheduled workweek was 37½ hours.

Most office workers in large cities receive pay for 7 holidays or more a year and 2 weeks of annual vacation after working 1 year. Longer vacations, granted on the basis of additional years of service, may range up to 4 weeks or more with pay. Life insurance; hospitalization; surgical and medical insurance; and sick benefits are also generally available, as are retirement pension plans supplementing benefits paid under the Federal Social Security program.

Sources of Additional Information

Many State employment service offices maintain occupational guides giving local information about earnings, hours, and employment opportunities in clerical occupations.

Teachers may obtain information concerning training for office occupations from:

Division of Vocational and Technical Education, Bureau of Adult Vocational and Library Programs, U.S. Office of Education, Washington, D.C. 20202.

Or by contacting their:

State Supervisor of Office Occupations Education, State Department of Education, State Capitol.

A directory of private business schools located in 300 cities throughout the country may be obtained from:

United Business Schools Association, 1730 M Street, NW., Washington, D.C. 20036.

Information of wages and related benefits for office workers in 88 metropolitan areas is given in the following publication:

Area Wage Surveys: Selected Metropolitan Areas 1968–69 (BLS Bulletin 1625–90), 1970. Superintendent of Documents, Washington, D.C. 20402.

Information on wages and related benefit earnings in 229 metropolitan area is summarized for the northeastern, southern, north central, and western regions, and for the United States as a whole, in the following publication:

Area Wage Surveys: Metropolitan Areas, United States and Regional Summaries, 1968–69 (BLS Bulletin 1650–91), 1970. Superintendent of Documents, Washington, D.C. 20402.

BOOKKEEPING WORKERS

(D.O.T. 210.368 through .588; 216.388; and 219.388 and .488)

Nature of the Work

Every business must have systematic and up-to-date financial records. Bookkeeping workers record day-to-day business transactions in journals, ledgers, and on other accounting forms. At regular intervals they also prepare income statements which show all money received and from whom and money paid and to whom.

Bookkeeping worker checks business transaction records.

In many small firms, one *general bookkeeper* (D.O.T. 210.388) does all of the analysis, recording, and other necessary bookkeeping work. Although employees may use simple office equipment, such as adding machines, they most often work by hand. Often they file, answer the telephone, prepare and mail customers' bills, and do other office work.

Large business organizations usually have many workers under the direction of a head bookkeeper. *Bookkeepers* (D.O.T. 210.388) and *bookkeeping* and *accounting clerks* (D.O.T. 219.488) each specialize in one or two kinds of bookkeeping work. Some workers may enter items in accounts payable or receivable ledgers and others may take trial balances, prepare income statements, or do additional bookkeeping.

Places of Employment

Of the more than 1.34 million bookkeeping workers in 1970, 9 out of 10 were women. Most bookkeeping workers do general bookkeeping or accounting. Large numbers work in retail stores, banks, insurance companies, and manufacturing and service firms.

Training, Other Qualifications, and Advancement

In selecting bookkeeping workers, most employers prefer high school graduates who have taken business arithmetic and bookkeeping. Some prefer applicants who have completed post-high school business training or junior college. Training which includes typewriting and the use of office machines is often helpful since many bookkeeping workers perform a variety of duties. An increasing number of large companies offer new accounting clerks on-the-job training. In some localities, companies cooperate with business schools and high schools in work-study programs to give students practical part-time experience that may be helpful in obtaining work after graduation.

Bookkeeping and accounting clerks should have above-average aptitude for working with numbers and the ability to concentrate on details.

Beginning bookkeeping workers usually start recording routine transactions and then advance to more responsible assignments. For example, experienced bookkeepers prepare income statements and operate complex bookkeeping machines. Some workers may be promoted to supervisors. Bookkeepers who complete college accounting may become accountants. (The occupation of Accountant is discussed elsewhere in the *Handbook.*)

Employment Outlook

Employment in this occupation is expected to increase slowly through the 1970's. Tens of thousands of workers will be needed each year as positions are created and replacements are needed for employees who retire, stop working, or transfer to other types of employment.

Growth in this field is expected to stem mainly from the increase in recordkeeping resulting from population expansion and economic prosperity. The increasing use of electronic data processing and other bookkeeping machines, is expected to limit somewhat the growth of employment requirements for bookkeeping workers. Many types of machines, such as posting machines, punchcard machines, and electronic computers, can process accounting and bookkeeping data more accurately, rapidly, and economically than can be done by hand. Nevertheless, the need for bookkeeping workers will probably outpace the laborsaving impact of office machines over the next 10 years.

Earnings and Working Conditions

According to a Bureau of Labor Statistics (BLS) survey of clerical occupations in private industry, beginning accounting clerks averaged $439 a month in 1970. More experienced clerks earned $568 a month.

Salaries of accounting clerks varied by location, size of firm, and type of employment. Highest salaries were usually paid to accounting clerks working in metropolitan areas for firms which employ at least 2,500 workers, or for public utilities.

Working conditions for bookkeeper employees are similar to those of other office workers in the same firms. (See introductory section to this chapter for more information on Earnings and Working Conditions and for Sources of Additional Information.)

CASHIERS

(D.O.T. 211.138, .368, .468, and .488 and 299.468)

Nature of the Work

Although cashiers usually receive payments made by customers for goods and services, their duties and job titles vary according to their work. In a theater, for example, the cashier may be called *box office cashier* or *ticket seller;* in a supermarket, *checkout clerk* or *grocery checker;* in an electric light and power company, *teller* or *bill clerk;* and in a cafeteria, *cashier-checker.* Very large business firms that have several cashiers sometimes use other special job titles such as *disbursement clerk, cash accounting clerk,* or *credit cashier.* (The occupation of bank cashier, which is different from other kinds of cashier jobs, is discussed elsewhere in the *Handbook.*)

Regardless of job title or employer, most cashiers accept money paid by customers, make change when necessary, and give some kind of receipt for the payment. They also keep records of the amount of money involved in each transaction so that cash accounts can be balanced at the end of the day. Many cashiers prepare cash and checks for deposit at the bank. Some pay out cash or write company checks to cover expenses such as the purchase of supplies and equipment; some prepare pay envelopes or paychecks, make out sales tax reports, and do related work.

In receiving payment for goods or services most cashiers use cash registers which print a record of the amount of the sale on a paper tape and release a money drawer. On some registers, cashiers list and total individual items purchased by each customer and record other details relating to the transaction. Other machines, somewhat like accounting machines, are used by cashiers in hotels and hospitals to record the charges for telephone, medical, and other services which are incurred and to prepare the itemized bills which cashiers present to guests or patients as they check out. Cashiers also may use adding machines, change-dispensing machines, and other special equipment.

Many cashiers have additional duties peculiar to the nature of their employers' businesses. In a theater, for example, the cashier may oper-

ate a ticket-dispensing machine and answer telephone inquiries. A restaurant cashier may handle reservations for meals and special parties, type menus, or be responsible for a candy and cigarette counter. In supermarkets and other self-service stores, cashiers often wrap or bag each customer's purchases and, during slack periods, restock shelves, mark prices on articles, and perform other work. In a hotel or motel the cashier's special duties usually include recording charges for telephone, valet, and other services used by each guest, and notifying the room clerk when guests check out.

Places of Employment

In 1970, about 90 percent of the 850,000 cashiers in the United States were women. They work for business firms of all types and sizes. Nearly three-fourths worked in grocery, drug, and other retail stores; large numbers also were employed in restaurants and theaters. Most of these establishments and other businesses which employ cashiers are located in cities and in the shopping centers of heavily populated suburban areas; however, many also are found in small towns.

Training, Other Qualifications, and Advancement

Employers hiring beginners to fill jobs as cashiers prefer high school graduates. Courses in business arithmetic, bookkeeping, typing, and other business subjects are good preparation. In some large cities, business organizations and schools offer brief courses through which students learn to operate a cash register and perform other duties of a cashier. Cashier training also may be offered as part of public school distributive education programs which include courses in retail selling or food service work.

For some kinds of cashier jobs, employers want persons who have special skills or business experience; for example, cashiers who know how to type or have had selling experience. Sometimes cashier jobs are filled by promoting clerk-typists in offices, bag boys in supermarkets, and other qualified people already employed by the firm.

Beginners usually are trained informally on the job under the supervision of an experienced employee. Sometimes, particularly in large firms, trainees attend a brief period of classroom instruction. Some firms train all newly-hired cashiers regardless of previous experience.

Cashiers should have an aptitude for working with figures, finger dexterity, and a high degree of eye-hand coordination. Accuracy is particularly important. Since cashiers deal with the public, they also should be tactful, neat in appearance, and able to deal with their customers in a pleasant and courteous manner.

Promotional opportunities for cashiers are likely to be limited, particularly in small firms. The cashier's job, nevertheless, affords a young person a good opportunity to learn how his employer's business affairs are conducted and so may serve as a steppingstone to a more responsible clerical job or to some types of managerial positions.

In chainstores and other large retailing enterprises, for example, cashiers eventually may advance to department or store managers.

Employment Outlook

Employment in this large occupation is expected to increase rapidly through the 1970's. Tens of thousands of workers will be needed each year to fill new positions and to replace cashiers who retire or stop working for other reasons. Still other workers will be needed to replace cashiers who transfer to other types of employment.

Employment is expected to increase mainly because of the anticipated expansion in business activity. In addition, more retail stores will undoubtedly adopt self-service and other merchandising techniques which create jobs for cashiers. The increase in employment due to changes of this kind, however, probably will be somewhat less marked than during the 1960's when conversion to self-service on the part of some kinds of retailers was widespread. The continued use of vending machines, changemaking machines, and other mechanical equipment which replaces cashiers or speeds up their work also will tend to limit the expansion in employment during the 1970's.

Opportunities probably will continue to be best for cashiers having typing, bookkeeping, or other special skills. There also should be many opportunities for cashiers who wish to work part time.

Earnings and Working Conditions

The salaries earned by beginning cashiers in routine jobs are often at or near the minimum wage required by State and Federal laws. In several States and in establishments covered by the Federal law, the minimum was $1.60 an hour in 1970; elsewhere, starting salaries were somewhat lower. Unionized cashiers, as well as some others in jobs which involve a considerable degree of responsibility or require specialized training, may earn considerably more than the legal minimum; often more than $2 an hour. Grocery checkers employed by supermarkets may earn more than $3 an hour.

Cashiers' hours may differ from those of many other clerical workers because they often work during rush periods which are outside regular office hours. Holiday, weekend, late afternoon, and evening work may be required, especially in theaters, restaurants, and food stores. Many cashiers in these establishments work part time or on split shifts. Cashiers employed full time in supermarkets and other large retail establishments usually work a 5-day, 40-hour week but, since Saturday is a busy day in retailing, most cashiers usually work on that day and have another day off during the week.

Most cashiers work indoors, often in small booths or behind counters near the entrances of stores, theaters, and other establishments. In some cases, their quarters may be uncomfortable because they are exposed to cold drafts in the winter and considerable heat during the summer.

(See introductory section of this chapter for Sources of Additional Information.)

ELECTRONIC COMPUTER OPERATING PERSONNEL

(D.O.T. 213.138, .382, .582, .588, and .885; and 223.387)

Nature of the Work

An electronic computer may require many specialized operators. First, the "input" must be coded. Then someone must operate the computer console; finally, the "output" must be translated back into words and numbers to be read. These procedures vary among computer systems; often they are more involved and difficult to learn than operating the equipment itself. The number and kinds of employees needed also vary. A computer no larger than an office desk may need one or two employees. A large system, on the other hand, requires several specialized workers.

"Input" consists of the data to be processed and step-by-step instructions prepared by programers. (Information about the occupation of Programer is given elsewhere in the *Handbook.*) In many systems, the input consists of punched cards prepared by *keypunch operators* (D.O.T. 213.582) or of paper tapes prepared by *data typists* (D.O.T. 213.588). Keypunch operators use machines similar to typewriters that punch holes in cards to represent specific items of information. Less frequently, input may be prepared by adding or bookkeeping machine operators using machines with special attachments to perforate tapes.

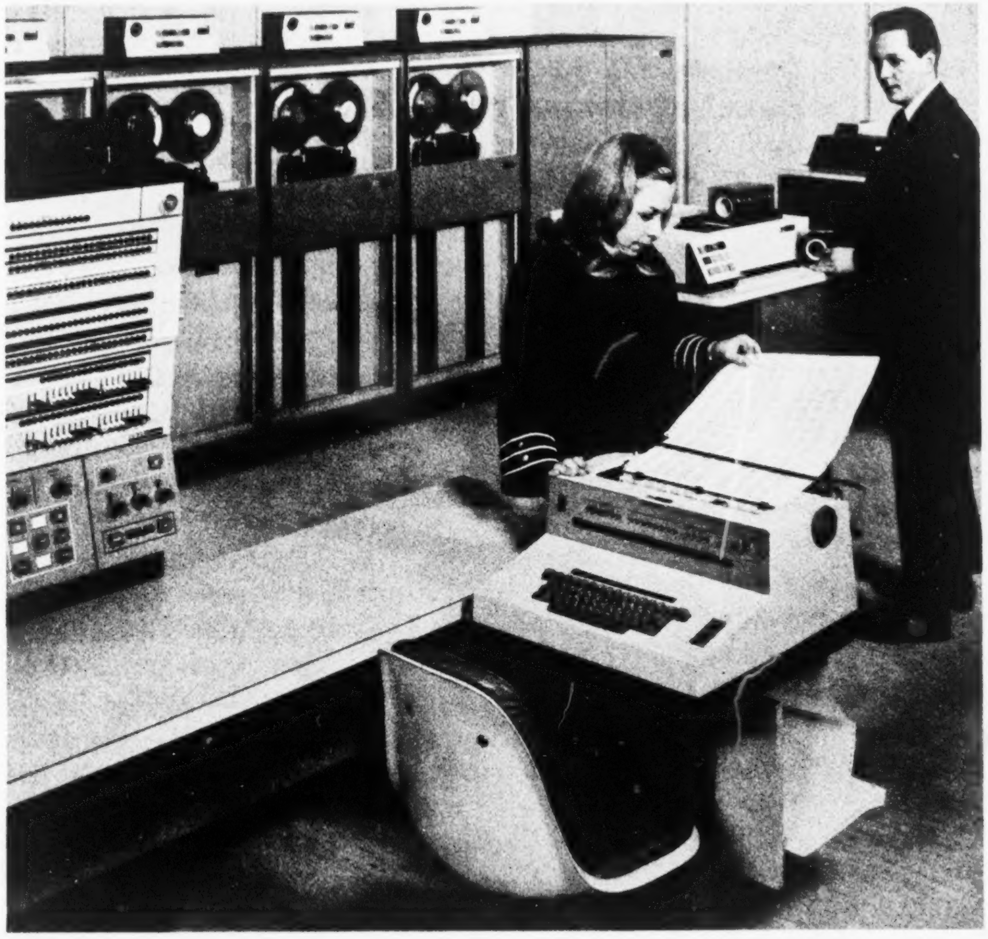
In some computer systems, punched cards or paper tapes feed information directly into the central computer. In other systems, small computers or terminals, linked to the central computer by telephone lines, supply the information. Faster computer systems obtain their input from "direct access" devices featuring magnetic surfaces on which data are recorded by spots. Such devices include magnetic tapes, discs, data cells, and data drums. These systems include auxiliary equipment that records directly on magnetic surfaces or transfers data from punched cards or paper tapes to the magnetic surface.

Small computers transfer data in some systems. Other machines, used for the same purpose, are called converters and are run by *card-to-tape converter operators* (D.O.T. 213.382). Converter operators may be required to wire a fairly simple plugboard and must know how to interpret signals from a panel of lights on the machine. They also should understand the whole system to recognize any errors in input and to identify other situations that prevent proper operation.

Once facts and figures have been coded, data are ready for the "run"—that is, to be processed. A *console operator* (D.O.T. 213.382) or computer operator operates the computer after examining the programer's instructions to ascertain procedures. He then makes sure the computer is loaded with tape, discs, or cards, and starts the run. He may manipulate dozens of switches and observe numerous lights. If the computer stops or lights signal an error, he must locate the difficulty.

To be read, output must be translated from machine language to words and numbers. In some systems this is done by machines directly connected to the computer. In many large systems, however, this work is done on converters, high-speed printers, and other machines run by auxiliary equipment operators—*tape-to-card converter operators* (D.O.T. 213.382), *high-speed printer operators* (D.O.T. 213.382), and others.

Computer data on tape, discs, or cards are stored by a *tape librarian* (D.O.T. 223.387) or a console operator or auxiliary equipment operator and often are used again and again—as in making up a payroll at the end of every pay period. Telephone lines which transmit data from computers have expanded the range of tasks of an auxiliary equipment operator. Many operators run communications as well as computing equipment. Two or three shifts of workers, under a chief supervisor, operate many computers for 16 to 24 hours a day.



Places of Employment

The number of console and auxiliary equipment operators employed in 1970 is estimated at 200,000. Jobs for operating personnel are found chiefly in government agencies and in insurance companies, banks, wholesale and retail businesses, transportation and public utility companies, and manufacturing firms. Many operators also are employed in independent service organizations that process data for other firms.

Training, Other Qualifications, and Advancement

Employers often transfer operators of tabulating and bookkeeping machines to newly installed electronic computers. Many other computer operators are recruited from the outside.

In hiring outsiders, private employers usually require at least a high school education. For console operators, some college training may be preferred. The Federal Government requires applicants for auxiliary equipment operator jobs to be high school graduates unless they have had specialized training or previous experience in related work. Console operators should have a high school education and some work experience. They also may qualify for appointment on the basis of previous experience in computer work and a general aptitude for it, as demonstrated by special tests. Many private employers also give tests to measure an applicant's aptitude, especially his ability to reason logically.

Beginners usually receive training after they are hired. The training of auxiliary equipment operators may require a few weeks, that of console operators somewhat longer. Console operators usually attend classes to learn to mount tapes and operate the console. They must become sufficiently familiar with the equipment to trace mechanical failures. This training is supplemented by further instruction on the job.

As they gain experience, operators may be assigned to more complex equipment and eventually promoted to supervisors or jobs that combine supervisory duties and console operation. Through on-the-job experience and additional study, console operators may qualify as programers.

Employment Outlook

The use of electronic data-processing equipment will continue to increase very rapidly through the 1970's as the economy grows. Computers are being adapted to new uses almost daily and, as they perform more varied tasks, many more business firms will be utilizing them. Although the size of the staff required to operate a computer installation may be reduced somewhat as new types of equipment are developed, the total number of computer and auxiliary equipment operators is expected to increase very rapidly.

Thousands of operators will be needed to fill new jobs, both in firms having their own computer installations and service centers that rent computer time to businessmen. Many operators also will be needed to replace operators of computer systems who transfer to other kinds of work or stop working.

The equipment changes that are expected in computers also may produce changes in job requirements for console and auxiliary equipment operators. Because of advances in technology, much of the equipment in use today is far less complex to operate than computers of the early 1950's and 1960's; and future changes may bring further simplification. As a consequence, newcomers to this field may find it easier to qualify for the openings available than have applicants in the past.

Earnings and Working Conditions

Information about the salaries of computer operating personnel is available from a nationwide private survey conducted in 1970. The average salary for beginning console operators was $122 a week. Some experienced console operators averaged up to $200 a week. The weekly salary of experienced keypunch operators averaged $112. The difference between the salary of the lowest and highest paid employees in each of the job classifications surveyed was much greater than these figures suggest, however. For example, the highest salary reported for a skilled console operator was $365 a week—more than 4 times the lowest salary reported for a comparable job. Many variations of this kind were due to differences in salary levels in various parts of the country and among individual companies and industries; to some extent, they also reflect differences in the complexity of the work performed by operators having the same job titles.

Salaries of computer personnel in the Federal Government are roughly comparable to those in private industry. In late 1970, beginning console operators started at about $113 a week. The maximum salary paid to experienced console operators in the Federal Government was about $190 a week; a few in supervisory positions may earn up to $273 a week, usually after several years of experience.

Operators of electronic computer systems generally work the same number of weekly hours and are allowed the same holidays, vacations, and other benefits as most office employees. Since many computers are operated on a two- or three-shift basis, scheduled hours for some console and auxiliary equipment operators include late evening or nightwork. Tape librarians usually work only when day shifts are on duty.

Because electronic computers must be housed where temperature is carefully controlled, operators work in air-conditioned rooms. A disadvantage of their working environment, however, is the high level of noise generated by the operation of computer consoles and some auxiliary equipment. (See introduction to this chapter for additional information on Working Conditions.)

Sources of Additional Information

Information on careers in electronic data processing may be obtained from:

Data Processing Management Association, 505 Busse Highway,
Park Ridge, Ill. 60068.

A list of reading materials giving information about computer operating personnel may be obtained from:

Association for Computing Machinery, 1133 Avenue of the
Americas, New York, N.Y. 10036.

FILE CLERKS

(D.O.T. 206.388)

Nature of the Work

Most establishments arrange their records in some order to prevent loss of time and money that often results when needed information can't be located. This creates opportunities for file clerks, who keep such records accurate, up to date, and properly placed. Their specific duties, however, depend on the size and type of establishment that employs them.

File clerks read the material to be filed and arrange it by number, alphabet, subject matter, or by some other filing system. The kinds of information filed vary by type of organization. File clerks employed by banks might file deposit or withdrawal slips, loan records, and correspondence; file clerks working for magazine publishers might file news items, subscriptions, and pictures.

Aside from inserting new data into files, file clerks usually perform duties related to existing files, such as entering additional information on materials in the files, investigating file records, and tracing missing file data.

Much of the file clerk's time is spent retrieving information stored in the files. In such instances, file clerks maintain records of materials removed from the files and see that materials given out are returned.

Some other file clerk functions are not carried out as often as those related to the storage and retrieval of data. Periodically, for example, obsolete file materials may be destroyed or transferred to inactive storage. From time to time, files may be checked to insure that materials are correctly placed; and folders, labels, and index cards may be prepared for use in the files. As changes take place in the characteristics of information filed, some file clerks establish new, or modify existing, filing systems.

In large organizations, the functions of file clerks may be so specialized that they perform only one duty. In small organizations, on the other hand, file clerks may also handle tasks closely related to their regular job, such as typing, sorting mail, or operating an office machine.

Places of Employment

Almost 170,000 workers—mostly women—were employed as file clerks in 1970. In addition, hundreds of thousands of workers in other kinds of clerical occupations also do filing in connection with their work.

Finance, insurance, real estate, and manufacturing establishments employed the largest number of file clerks in 1970, accounting for three-fourths of these workers.

Training, Other Qualifications, and Advancement

Most employers prefer high school graduates for beginning positions as file clerks. Business courses offered by public and private school are helpful—particularly typewriting, which is increasingly required. Other useful business subjects include bookkeeping or recordkeeping, clerical or office practice, and general business.

Some on-the-job training is usually necessary because each organization has its own filing system and office procedures with which the clerk must become familiar. In large establishments having specialized filing procedures, a clerk may learn her job in a few weeks. In small establishments that require file clerks to perform various duties, on-the-job training may last up to 3 months.

The ability to read accurately and rapidly and to spell correctly is important for this type of work. Other desirable traits include a sense of orderliness and a liking for detail.

Advancement for file clerks usually consists of performing more difficult filing work or supervising other file clerks. With additional training, these workers may advance to other clerical positions such as information clerk or office machine operator. (See statement on office machine operators elsewhere in the *Handbook.*)

Employment Outlook

Employment opportunities for file clerks are expected to be good through the 1970's, with several thousand openings expected yearly during this period. Most of these openings will be for workers to replace file clerks who retire or stop working for other reasons. Employee turnover is especially high among file clerks because many of the women who perform this work are young and leave the field to get married and care for a family.

Employment of file clerks is expected to rise rapidly through the 1970's as a result of the long-term growth of business and the need for more and better recordkeeping. New positions for file clerks are expected to open up as the businesses employing large numbers of file clerks—such as banks, insurance companies, and manufacturing firms—continue to expand. However, the increasing use of mechanical devices to arrange, store, and transmit records can be expected to limit employment growth for clerks of this type.

Earnings and Working Conditions

Beginning file clerks performing routine duties earned average weekly salaries of $80, according to a 1970 Bureau of Labor Statistics survey. Salaries of file clerks having some experience averaged $88.00 a week, and the most experienced file clerks performing more difficult duties averaged $106 a week. The survey indicated, however, that salary levels of files clerks varied considerably by location and size of firm.

The starting salary for beginning file clerks in the Federal Government in 1970 was about $80.00 a week ($4,125 a year); experienced file clerks earned about $105 a week ($5,212 a year).

Office employees, including file clerks, generally work a 40-hour week. In some cities, especially in the northeastern part of the country, the scheduled workweek is 37½ hours.

Most office workers in large cities receive pay for 7 or more holidays a year and for 2 weeks of vacation after working 1 year. Life and health insurance, sick benefits, and retirement pension plans supplementing benefits paid under the Federal Social Security program also are generally available.

Working conditions for file clerks are usually similar to those of other office workers in the same organization. File clerk work requires little heavy lifting but usually involves some bending and reaching. (See Clerical and Related Occupations, this chapter for Sources of Additional Information).

OFFICE MACHINE OPERATORS

(D.O.T. 207.782, .884 and .885; 208.782; 214.488; 215.388; 216.488; 234.582 and .885)

Nature of the Work

The types of machines used to speed paperwork in modern business offices are so varied that it would be almost impossible to list all of them. They range from simple mechanical devices that open letters to electronic equipment capable of performing highly involved computations. This statement is concerned with the work done by people whose main job is to operate some of the more common types of office machines. Many, such as the bookkeeping machine operator and billing machine operator, have job titles related to the kinds of equipment they use. (Typists, operators of transcribing machines, and operators of electronic computers are not included in this statement, but are discussed in other sections of this chapter. Others not included are clerical workers who occasionally use equipment such as copying machines, adding machines, and other mechanical devices; and statistical clerks who use calculating machines extensively in connection with their regular duties.)

Billing machine operators (D.O.T. 214.488) use machines that both type and add, in preparing statements relating to customers' purchases. By striking lettered and numbered keys on the machine, the operator enters on each bill such information as the customer's name and address, the items bought, and the amounts of money involved in each transaction. Then, when the operator presses other keys, the machine calculates and prints totals, discounts, and other items.

Bookkeeping machine operators (D.O.T. 215.388) use office machines that record all the financial transactions of a business. As the operator presses the necessary keys, the machine enters totals and net amounts on bookkeeping forms. Through the use of bookkeeping machines, operators also prepare periodic trial balances, summary reports, and other statistical information.

Adding and calculating machine operators (D.O.T. 216.488) use electrically and manually operated machines to make the computations needed in preparing payrolls and invoices, and in doing other statistical work. By striking numbered keys, operators "put into" these machines the numbers involved in each calculation. Then, when other keys are pressed, the machines compute the desired totals, and some may record the results automatically. *Adding machine operators* use their machines to add and subtract numbers, and sometimes to multiply. The calculator is more complex than the adding machine and usually has a much larger keyboard. *Calculating machine operators* and *Comptometer operators* use their machines not only to add, subtract, multiply, and divide, but also to get square roots, figure percentage distributions, and do other computations. Many office workers who operate adding machines and calculators part time also perform other office duties. However, operators of the most complex calculating machines—i.e., key-driven calculators which require considerable skill and knowledge—usually are occupied full time in this job.

Mail preparing and mail handling machine operators (D.O.T. 234.582 and .885) run automatic equipment which handles incoming and outgoing mail. Only in offices which handle a very large volume of mail does this work require a full-time operator. Some operators feed incoming mail into machines which open the envelopes. Other operators place outgoing mail on the loading racks of machines which fold enclosures and/or insert them in envelopes or address, seal, or stamp envelopes. Operators of addressing machines run machines which print addresses and related information either from stencils which have been cut by typists or from plates prepared by *embossing machine operators* (D.O.T. 208.782) on a special kind of typing machine.

Operators of duplicating machines handle equipment which produces copies of typewritten, printed, and handwritten documents more quickly and/or inexpensively than is possible by typing. Although some equipment of this kind can be operated by almost any office employee, the more complicated duplicating machines, which are capable of producing thousands of copies of typewritten and handwritten documents in a single "run," are usually operated by trained *duplicating machine operators* (D.O.T. 207.782, .884 and .885) who spend most of their time doing this work. The operators who use these machines insert in the machine a "master" copy of the document and reproduce it. Each operator must see that the machine is kept properly adjusted so that it produces legible copies. On some machines, the operator also feeds in the paper used for making copies and removes finished batches of work manually; on other machines, feeding and offbearing are done automatically.

Operators of tabulating machines and related equipment (D.O.T. 213.782) run machines designed to sort and count large quantities of accounting and statistical information. Information to be processed in a tabulating machine is inserted through punched cards into machines which count the various items punched on each card, multiply and make other calculations, and print the results on accounting records and other business forms.

Places of Employment

About 365,000 people were employed as office machine operators in 1970. (This total does not include 200,000 electronic computer operators. This occupation is discussed elsewhere in this chapter.) About three-fourths of all office machine operators are women.

Office machine operators are employed chiefly in firms handling a large volume of recordkeeping and other paperwork. Consequently, a great many operators work in large cities where such firms are usually located. Approximately one-third of all office machine operators work for manufacturing companies. Others work for banks and insurance companies, government agencies, and wholesale and retail firms. Some office machine operators are employed in "service centers"—agencies equipped with various kinds of office machines which contract to handle—for other firms without this equipment—tasks such as preparing monthly bills and mailing circulars to lists of prospective customers.

Training, Other Qualifications, and Advancement

Graduation from high school or business school is the minimum educational requirement for all but the most routine office machine operator jobs. For work such as operating key driven calculators and some kinds of tabulating and duplicating equipment, specialized training is usually necessary. For many beginning positions, however, a general knowledge of the equipment used is usually sufficient. Public and private school courses in the operation of office machines are helpful, and business arithmetic is valuable for the many jobs involving work with figures. It is helpful also for office machine operators to have some knowledge of typing, or to be able to operate more than one type of office equipment, since many office positions entail varied assignments.

Employers usually give newly hired office machine operators some on-the-job training. Even employees who have training or experience in office machine operation need to become familiar with the particular equipment they will be using on the job; differences exist between the calculating machines produced by one manufacturer and by another, and new models sometimes differ considerably from older models.

The amount of instruction and on-the-job experience needed by a beginner varies, depending chiefly on the type of machine. A few days may be sufficient to train operators of some duplicating machines; however, a few weeks may be needed for training calculating machine operators. Operators of calculating machines are often trained at company expense in special schools established by equipment manufacturers.

Finger dexterity, coordination of eye and hand movements, and good vision are important for most office machine operator jobs. It is helpful for billing and calculating machine operators to have a sufficient sense of mathematical relationships to enable them to quickly detect obvious errors in computations. Some mechanical ability is advantageous, especially for duplicating and tabulating machine operators.

Most employers follow a promotion-from-within policy, taking into consideration seniority and on-the-job performance as shown by supervisors' ratings and recommendations. Promotion may be from a beginning, routine machine job to a more complex one, or the promotion may be to a related clerical job. Often, employers provide the additional training required in such cases. Advancement for office machine operators employed in firms which have large clerical staffs may be to positions in which they are responsible for training beginners and for the accuracy of their work, or else to supervisory positions as section or department heads.

Employment Outlook

Thousands of job openings for office machine operators are expected each year through the 1970's. Most will result from the need to replace workers who retire or stop working for other reasons. Many machine operators are young women who stop working to care for their families. Other openings are expected to result from the introduction of new types of mechanical office equipment which speed recording, copying, and related office work. Still other openings will occur as business organizations continue to grow in size and number, and the volume of billing, computing, duplicating, and other work continues to mount.

Employment of office machine operators is expected to increase moderately through the 1970's. In some offices, however, the number of workers needed to operate tabulating, billing, and other types of machines may be reduced by the spread of automated recordkeeping systems and further advances in office automation. Also, advances in interoffice communications devices for transmitting data and electronic computer technology should enable many large firms and government agencies to centralize recordkeeping functions. Thus, the requirements for office machine operators in small branch offices will be reduced. Any reductions in employment however, are expected to be more than offset by the new jobs created as the volume of paperwork continues to increase in business establishments of all kinds.

Earnings and Working Conditions

A 1970 Bureau of Labor Statistics survey, covering firms in metropolitan areas, provides salary information for several office machine operator occupations. For bookkeeping machine operators, the averages are given separately for different skill groups. Operators in Class A were generally experienced employees who performed comparatively difficult work, while Class B operators worked on more routine assignments and used simpler types of equipment. The average weekly salaries reported by this survey are shown in the accompanying tabulation.

	Average weekly salaries, 1970	
	Women	*Men*
Billing machine operators	$ 92.00	$127.00
Bookkeeping machine operators		
Class A	105.50	113.50
Class B	89.00	102.00
Comptometer operators	97.00	......

Because of the noise created by their machines, groups of operators often work in areas which are apart from other company offices. In other respects, working conditions for office machine operators usually are similar to those of other office workers in the same firms. (See introductory section to this chapter for further information on Working Conditions and for Sources of Additional Information.)

RECEPTIONISTS

(D.O.T. 237.368)

Nature of the Work

Most large organizations—and many small ones—employ receptionists to greet customers and others with whom they deal, and give them information. It is the receptionist's job to determine the nature of each caller's business, and then to direct him to those in the office who may be able to help him.

Receptionists usually refer each caller to the appropriate person in the organization, or else contact his office by telephone and arrange an appointment. Because of differences in the types of organizations where they work, receptionists may have somewhat different duties. In a hospital clinic, for example, the receptionist may direct each patient to the proper waiting room; in a beauty shop, she may arrange an appointment and accompany the customer to the operator's booth; and in a large defense plant, it may be part of the receptionist's job to provide the caller with an identification card and see that an escort is available to accompany him to the office of the official with whom he has business. In connection with these duties, many receptionists also keep records showing the name of each caller, the nature of his business, the time of his call, and the person to whom he was referred.

Most receptionists, particularly in small offices, have some time when they are not occupied with callers; as a result, they may handle other office tasks. Many receive and route telephone inquiries to the proper company officials. Typing, sorting and opening mail, filing, keeping books or petty cash accounts, or operating an office telephone switchboard may be among their additional responsibilities.

Places of Employment

It is estimated that almost 300,000 receptionists were working in the United States in 1970. About one out of four was a part-time worker who spent fewer than 35 hours a week on the job. More than 95 percent were women.

Although jobs for receptionists exist in practically all kinds of establishments, over half of the people in this occupation are employed in the offices of physicians, attorneys, and other professional people. Many others are employed by hospitals and educational institutions, and still others by banks, insurance companies, real estate offices, manufacturing concerns, and beauty shops. The relatively small number of men who are employed as receptionists work principally in medical service and hospital jobs, in manufacturing, and in banking and credit agencies.

Training, Other Qualifications, and Advancement

When hiring receptionists, employers seldom specify any formal educational requirements beyond a high school diploma. Nevertheless, about 1 receptionist out of 5 has some college training. Courses in English, spelling, typewriting, elementary bookkeeping, and business practices are assets for a beginner. The ability to operate an office telephone switchboard also may be desirable, although this skill often is acquired through on-the-job training. (See statement on Telephone Operators.)

Because the receptionist's job is to act as her employer's public representative, personal characteristics, such as a pleasant manner and an even disposition, are very important. An attractive personal appearance, pleasant speaking voice, good judgment, punctuality, and the ability to communicate information accurately also are necessary qualities. To perform her job effectively, the receptionist should acquire a thorough understanding of how her employer's business is organized.

The receptionist's job generally offers limited opportunities for promotion and advancement. However, work as a receptionist, plus business training, may lead to a better paying position as a secretary or an administrative assistant.

Employment Outlook

The number of receptionists is expected to increase moderately during the 1970's. Thousands of workers will be needed annually because of employment growth and the need to replace receptionists who retire or stop working for other reasons. Additional openings will arise as receptionists transfer to other types of employment. However, young applicants probably will meet strong competition, since many older and more experienced workers also seek this type of work. A few opportunities will continue to be available for men.

The chief factor affecting employment growth in this occupation is the expected general business expansion associated with population increase and economic prosperity. In addition, more business firms are realizing the importance of the receptionist in promoting good public relations. Since the receptionist's work is of a person-to-person nature, it is unlikely to be affected by office automation.

Earnings and Working Conditions

Switchboard-receptionists earned average salaries of $92 a week in 1970, according to a Bureau of Labor Statistics survey of 229 metropolitan areas. However, salary levels of these workers varied considerably by type and location of employer. For example, receptionists employed in the western United States averaged $98 a week while those in the South averaged $85 a week.

In the Federal Government, workers employed as information receptionists started at about $90 a week ($4,621 a year) in 1970. For experienced workers, starting salaries were higher—about $100 or $110 a week ($5,212 or $5,853 a year), depending on the nature of their previous experience.

Particularly in large business offices, receptionists usually work in well-furnished front offices, free from noise and overcrowding. In hospitals, beauty shops, and some other types of businesses, scheduled hours may include some weekend and evening work. (See introductory section to this chapter for further information on Working Conditions and for Sources of Additional Information.)

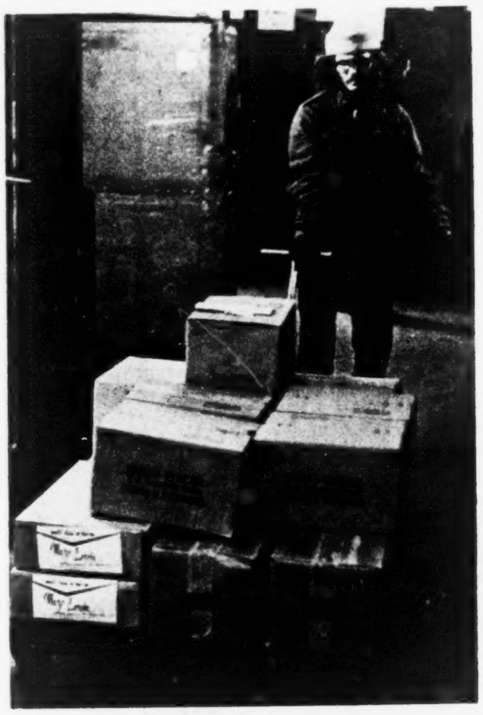
SHIPPING AND RECEIVING CLERKS

(D.O.T. 222.138 through .687)

Nature of the Work

Shipping and receiving clerks keep track of goods transferred from one place to another by business firms. Their specific duties depend on the size and type of establishment which employs them. In many small companies, one clerk keeps records of all shipments sent out and received by his employer. In larger companies, however, shipping and receiving clerks may be employed in separate departments under supervisors called head shipping clerks or head receiving clerks —or sometimes warehouse managers.

Before a shipment is sent from a business establishment to a customer, shipping clerks check to be sure the order has been correctly filled. They prepare the invoices and other shipping forms needed, look up freight and postal rates, record the weight and cost of each shipment, and check to see that the shipment is properly addressed. They also keep records of the date and other details associated with each shipment. Sometimes shipping clerks requisition the needed merchandise from the firm's stockroom, wrap and pack the shipment, and direct its loading on company trucks. They also may ensure that the weight is evenly distributed and fragile items are safely placed.



Receiving clerks do similar work when shipments reach their destination. They find out whether their employer's orders have been correctly filled by verifying incoming shipments against the original order and the accompanying bill of lading or invoice, and they check to see whether the merchandise in each shipment has arrived in good condition. Receiving clerks record all incoming shipments, their condition, and do clerical work related to damaged or lost shipments. Routing shipments to the proper department of the company or section of the warehouse or to the stockroom also may be part of their job.

Places of Employment

The number of shipping and receiving clerks employed in 1970 is estimated at 380,000. About two out of every three worked in manufacturing firms and another fairly large group worked for wholesale houses or retail stores. More than 85 percent of all shipping clerks are men. Establishments employing shipping and receiving clerks tend to be concentrated in metropolitan areas.

Training, Other Qualifications, and Advancement

High school graduates are preferred for beginning jobs in shipping and receiving departments. Business arithmetic, typing, and other high school business subjects are helpful in preparing for the work. The ability to write legibly is important. Dependability and an interest in learning about the firm's business activities are also qualities which employers seek.

New employees usually are given on-the-job training under the supervision of an experienced worker. This training covers the special care and skill required when the shipments include merchandise such as garments or scientific instruments; and a knowledge of the regulations which apply to shipments received from or forwarded to other countries.

In some firms, stockroom workers help beginners acquire a knowledge of the firm's products and business transactions. In shipping and receiving rooms, newly hired clerks often start by doing routine work such as filing; checking addresses; attaching labels to shipments; and checking the items included in shipments. As clerks acquire experience, they may be assigned tasks requiring a good deal of independent judgment—for example, handling problems that arise because of damaged merchandise, or supervising other shipping or receiving room workers.

Work as a shipping or receiving clerk provides an excellent opportunity for an ambitious young man to learn about his company's products and business connections. Some clerks, particularly those who acquire post high school training or take courses in transportation, may eventually advance to warehouse managers, industrial traffic managers, or purchasing agents. (The work of industrial traffic managers and purchasing agents is discussed elsewhere in the *Handbook.*)

Employment Outlook

Several thousand openings for shipping and receiving clerks are expected annually during the 1970's as employment rises and as workers retire, stop working for other reasons, or transfer to other types of employment.

As the quantity of goods distributed increases with population growth, rising income levels, and business expansion, the number of shipping and receiving clerks is likely to rise slowly. Employment probably will not increase as fast as the volume of goods distributed. Shipping and receiving departments in firms handling large quantities of merchandise will undoubtedly be able to handle a greater volume of work with fewer clerks, as they continue to increase efficiency by streamlining recordkeeping and modernizing warehouses through installation of moving belts and other laborsaving equipment.

Earnings and Working Conditions

Shipping and receiving clerks averaged $3.07 an hour according to a 1970 Bureau of Labor Statistics survey covering 229 metropolitan areas. Average earnings were lowest in the Southern region, $2.79 an hour, and highest in the North Central region, $3.22 an hour.

Salary levels of shipping and receiving clerks in comparable jobs varied also, due to differences in the industries in which they were employed.

Shipping and receiving clerks generally work a 40-hour week. Many receive time and a half for work over 40 hours. Nightwork and overtime, including work on Saturdays, Sundays, and holidays, may be necessary when raw materials are needed immediately on factory production lines, when shipments have been unduly delayed in arriving, or in other emergencies. Shipping and receiving clerks do much of their work in warehouses and shipping and receiving rooms; they may do some of it on outside loading platforms. Work places are often large, unpartitioned areas which may be drafty and cold, and littered with packing materials and containers.

Some of the work done by shipping and receiving clerks requires physical stamina and strength. Most clerks must stand for long periods while they check quantities of merchandise. Locating numbers and descriptions on cartons often requires a great deal of bending, stooping, and stretching. Also, under the pressure of getting shipments moved on time, clerks may help load or unload materials in the warehouse. (See introductory section this chapter for Sources of Additional Information.)

STOCK CLERKS

(D.O.T. 223.387)

Nature of the Work

Most employers recognize the importance of keeping well-balanced inventories in order to prevent losses in sales or slowdowns in production. Stock clerks help protect against such losses by controlling the flow of goods received, stored, and issued Their basic duties are similar in all establishments, but their specific responsibilities vary greatly by size and type of firm and the number of items handled.

In small firms, stock clerks may perform the varied duties of receiving clerks, shipping clerks, and inventory clerks; whereas in large firms stock clerks may be responsible for only one of these functions.

The duties of stock clerks also depend on the items they handle. For example, stock clerks working with a wide variety of foods and drugs must maintain proper temperature and humidity conditions. Stock clerks responsible for large construction items may be required to do much walking and climbing to note the condition and quantity of that stock.

Stock clerks usually receive and unpack incoming merchandise or material. They may check the items for quality and quantity and sometimes make minor repairs or adjustments. They also report damaged or spoiled goods and process papers necessary for obtaining replacements or credit.

Stock clerks store materials in bins, on the floor, or on shelves, according to the plan of the stockroom. They may organize and mark items with identifying codes, letters, figures, or prices so that inventories may be located quickly and easily. Stock clerks always maintain a record of items entering or leaving the stockroom. They may also prepare inventory reports showing stock balances resulting from a perpetual inventory system or from taking periodic physical inventories. In addition, stock clerks sometimes order supplies and also may label, pack, crate, or address goods for delivery.

Many stock clerks, such as film library clerk, tool clerk, and parts clerk have job titles related to the items they handle.

Places of Employment

About 500,000 stock clerks were employed in 1970; 80 percent were men. Most worked in manufacturing and in wholesale and retail trade. Large numbers of stock clerks were also employed by mail-order houses, airlines, government agencies, hospitals, transportation companies, and other establishments that keep large quantities of goods on hand. The majority of stock clerks work in metropolitan areas where large factories, warehouses, stores, and other large goods-handling organizations are concentrated.

Training, Other Qualifications, and Advancement

Although there are no specific educational requirements for becoming a stock clerk, most employers prefer high school graduates. Employers look for proficiency in reading, writing, mathematics, typing, and filing. Good health, especially good eyesight, is important. As with most jobs, attentiveness, honesty, and the ability to get along with people, also are important. Stock clerks handling jewelry, liquor, or drugs are often bonded.

Stock clerks usually receive on-the-job training. New workers are first given simple tasks such as counting and marking stock. Basic responsibilities of the job are usually learned within several weeks. As they progress, stock clerks learn to keep records of incoming and outgoing materials, take inventories, and order supplies.

Advancement opportunities vary and often depend on the size of the establishment. In a small firm, the stock clerk may advance to a sales position or become an assistant buyer or purchasing agent. In a large establishment, the stock clerk may also advance to more responsible stock clerk positions such as invoice clerk, stock control clerk, or merchandise supply man. Advancement to the position of supervisor or manager of the stockroom is possible, but usually additional education and a knowledge of marketing are required.

Employment Outlook

Continuing population growth, rising income, and business expansion will result in a moderate employment increase for stock clerks through the 1970's. Many job openings will arise annually because of this employment growth, as well as the need to replace those who retire or stop working for other reasons. The increased use of electronic computers and other mechanical devices to control inventories and other closely related work, however, can be expected to limit growth in this occupation.

Because entrance into this occupation is relatively easy, and since many young people seek this work as a first job, some competition for openings is likely.

Earnings and Working Conditions

Earnings of men and women doing stock clerk type work in metropolitan areas averaged about $125 and $92 a week respectively in 1970, according to a Bureau of Labor Statistics survey. Differences in pay between men and women are explained in part by differences in the industries where they are employed, length of service, and minor variations in job duties. The earnings of stock clerks employed by the Federal Government generally ranged between $110 and $140 a week in 1970.

Stock clerks usually work a 40-hour week and receive the same fringe benefits as office employees in the same establishment. Those working in metropolitan areas usually have at least 7 paid holidays a year and 2 weeks of vacation after working 1 year. Life and health insurance and sick benefits also are generally available, as are retirement pension plans supplementing benefits paid under the Federal Social Security program.

The working conditions of stock clerks vary by type of employer. Although stock clerks usually work in relatively clean, heated, and well-lighted areas, some stockrooms may be damp and drafty. Clerks handling refrigerated goods may spend some time in cold storage rooms. Stock clerks spend much of their working day on their feet, often on a concrete floor. The work often involves considerable bending, lifting, and climbing. (See introductory section of this chapter for Sources of Additional Information).

STENOGRAPHERS AND SECRETARIES

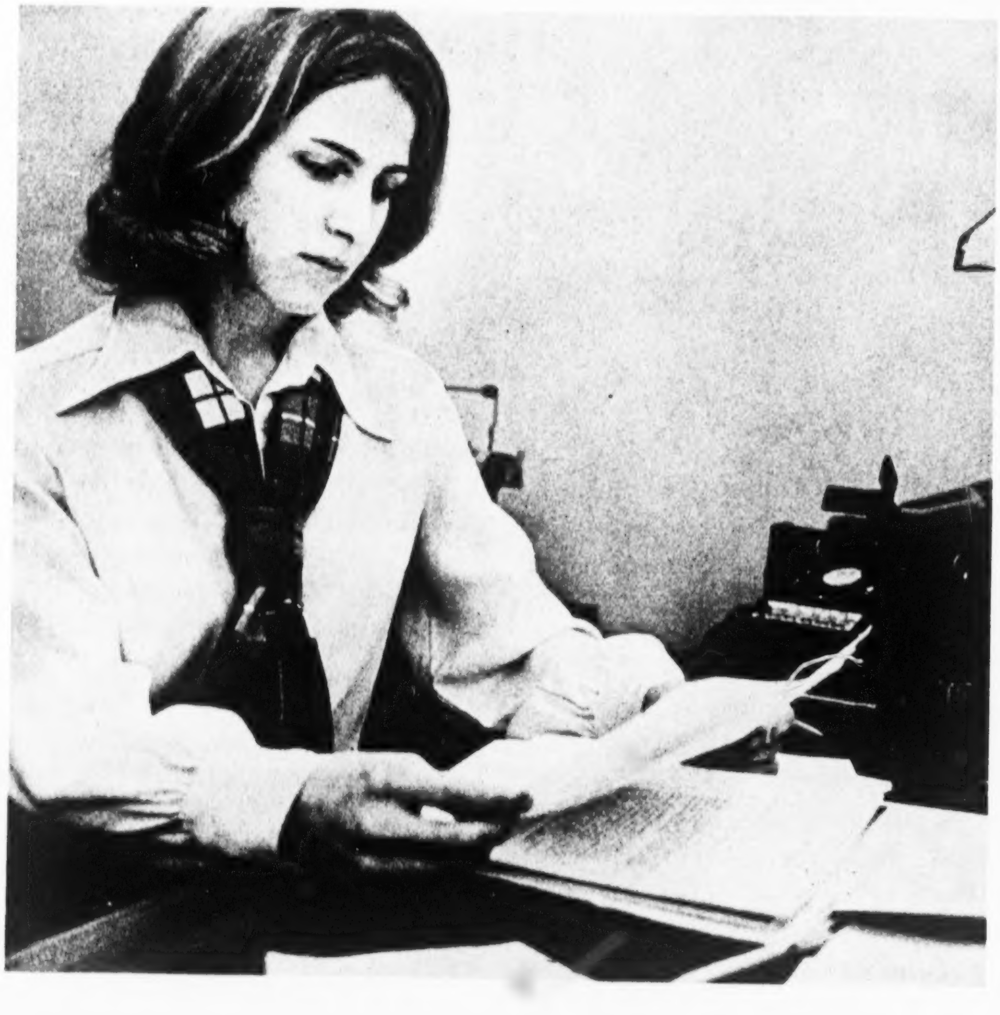
(D.O.T. 201.268 and .368 and 202.388)

Nature of the Work

About 2.8 million persons were employed in occupations requiring stenographic skills in 1970. More than 95 percent were women. Practically all stenographers and secretaries take dictation and transcribe it on a typewriter. They usually have additional duties related to the nature of their employer's business; they sometimes have special job titles which reflect their skill levels or work specialties.

Stenographers (D.O.T. 202.388) take dictation from one or more persons and then transcribe their notes on a typewriter. Most stenographers record their notes in shorthand; some use machines which print symbols as different keys are pressed. In addition to taking and transcribing dictation, many stenographers also do other kinds of typing, answer telephones, operate various office machines, and perform other clerical duties. Some stenographers, including most beginners, are classified as *general stenographers;* they take fairly routine dictation and perform routine office tasks. More experienced *senior stenographers* have a higher degree of stenographic speed and accuracy, and perform more responsible clerical work. Some senior stenographers, called *technical stenographers,* take dictation in medical, legal, or scientific terms; others take dictation in a foreign language; and still others work as *public stenographers.*

Some stenographers specialize in shorthand reporting. Included in this group are *court reporters,* who record proceedings in law courts. Other *reporting stenographers* record proceedings at conventions and other meetings; report statements made at press conferences and before Government legislative committees; and do other kinds of word for word reporting. Reporting stenographers take their notes by machine or, less frequently, in written shorthand. Then, they either transcribe them on a typewriter or dictate them onto sound-producing records which are later transcribed by typists. Stenographers who do this kind of work must be exceptionally rapid and accurate—sometimes taking notes in technical language from many speakers and for extended periods of time.



In addition to stenographic work, *Secretaries* (D.O.T. 201.268) relieve employers of routine duties and business details.

Duties vary and depend on the employer's business and the secretary's experience and capabilities. Secretaries often arrange airline and hotel reservations, and take care of some kinds of correspondence. Some times they supervise other personnel. Some secretaries specialize in legal, medical, and other technical work. *Social secretaries* (D.O.T. 201.268) arrange social functions and attend to personal and social matters for employers.

Places of Employment

Although organizations of every size and type employ stenographers and secretaries, more than half work for service; finance, insurance, and real estate; and government organizations. Many technical stenographers and secretaries work for physicians, attorneys, and other professional people. A few—chiefly public stenographers and some reporting stenographers—are self-employed. Stenographic and secretarial jobs for men tend to be concentrated in educational and other professional services, and in manufacturing and public administration. Many of the nearly 15,000 stenographers who specialize in shorthand reporting are men.

Training, Other Qualifications, and Advancement

Adequate performance as a stenographer or secretary requires a good basic education and technical training. Graduation from high school is essential for practically all positions. Graduates whose high school courses have included shorthand, typing, and other business subjects meet the requirements of many employers. Some employers prefer a background of academic high school subjects, supplemented by technical training taken after graduation.

Daytime and evening courses that prepare students for stenographic and secretarial work are offered by hundreds of public schools, private business schools, and colleges throughout the country. In connection with high school courses in business subjects, some public schools conduct cooperative programs which enable students to acquire practical work experience under trained supervision. Also, the Federal Government sponsors training programs for unemployed and underemployed workers for entry positions as stenographers under provisions of the Manpower Development and Training Act. Associate degrees in the field of secretarial studies are conferred by a great number of junior and community colleges. Bachelor's degrees in the field of executive secretary are conferred by the schools of business and commerce in many universities; a few confer the master's degree.

Some courses which train for stenographic work are limited to shorthand and typing and can be completed in a few months. In other courses which usually last longer, students also may be taught additional office skills and receive instruction in general business practices and office conduct. Some courses provide intensive training to prepare students for stenographic reporting or for legal, technical, or medical-dental secretarial work.

Many different shorthand systems are used, some of which are faster than others. Employers seldom have strong preferences about the system a stenographer uses, but they usually regard the rate of speed as an important factor. To qualify for positions in the Federal Government—and for employment in many private firms—stenographers must be able to take dictation at a rate of at least 80 words a minute and type 40 words or more a minute. Although speed requirements in some positions may be less than this, in others—especially shorthand reporting—they are much greater. Many shorthand reporting jobs require dictation speeds of 200 words or more a minute. For beginning shorthand reporters in the Federal Government, the minimum is 160 words a minute.

Good hearing and a working knowledge of spelling, punctuation, grammar, and vocabulary are essential in stenographic and secretarial positions. Employers seek workers who are poised, alert, and have pleasant personalities. Discretion, good judgment, and initiative are also important, particularly for the more responsible secretarial positions.

Capable and well-trained stenographers and secretaries have excellent opportunities for advancement. Many stenographers advance to better paying positions as secretaries; others, who acquire the necessary speed through experience or additional training, may become reporting stenographers. Both stenographers and secretaries may eventually be promoted to jobs such as administrative assistant, office supervisor, executive secretary, or some other responsible position requiring specialized knowledge of the employer's industry or business.

Employment Outlook

As modern businesses continue to expand in size and complexity, the increased paperwork will lead to a rapid expansion in the employment of secretaries and stenographers. The increasing use of dictating, duplicating, and other office machines will undoubtedly continue, but technological changes of this kind are not expected to greatly affect the growth of employment in these occupations.

Thus, employment opportunities for workers who have stenographic skills are expected to be favorable through the 1970's. About one hundred thousand workers will be hired annually to fill new jobs, and an even greater number will be needed to replace stenographers and secretaries who retire or stop working for other reasons. Turnover among stenographic workers is high because many young women leave to care for their families. Some openings also will occur as stenographers and secretaries leave their jobs to enter other types of employment.

Earnings and Working Conditions

In 1970, persons employed as general stenographers in metropolitan areas surveyed by the Bureau of Labor Statistics earned average salaries of $461 a month. Salaries earned by senior and technical stenographers working in metropolitan areas averaged $526 a month.

The salaries earned by individuals included in the survey varied considerably, partly because of differences in the location and industry where they were employed, but also because of differences in experience. The earnings of reporting stenographers generally are considerably higher than those of other stenographic workers.

Salaries of secretaries to supervisors in small organizational units or nonsupervisory staff specialists averaged $522 a month throughout the United States, according to the same survey.

Secretaries to officers in small companies and to middle management executives in large companies earned average monthly salaries of $582 and $625 respectively. Secretaries having even greater responsibilities earned average salaries of $679 a month.

The entrance salary for beginning stenographers in the Federal Government in 1970 was $5,212 a year. (See introductory section of this chapter for additional information on working conditions.)

Sources of Additional Information

Additional information on careers in secretarial work, as well as a directory of business schools, may be obtained from:

United Business Schools Association, 1730 M Street, NW., Washington, D.C. 20036.

Information regarding shorthand reporting may be obtained from:

National Shorthand Reporters Association, 25 West Main St., Madison, Wis. 53703.

For information on becoming a certified professional secretary, write to:

The Institute for Certifying Secretaries, 616 East 63rd St., Kansas City, Mo. 64110.

See introductory section of this chapter for additional sources of information.

TYPISTS

(D.O.T. 203.138 through .588; 208.588; and 209.388 through .588)

Nature of the Work

Typists operate the one machine found in practically every business office—the typewriter. Their main job assignment is to produce typed copies of printed and handwritten materials; in this respect, their work differs from that of many other office employees, who also do some typing but whose principal job assignment is different.

Practically all typewriters, including the electric machines being used in an increasing number of offices, have the same type keyboard and are operated in much the same way. Some typing jobs are considerably more difficult than others, however. Beginners, sometimes called *junior typists,* often address envelopes, type headings on form letters, copy directly from handwritten or typed drafts, and do other routine work. Experienced, or *senior typists,* generally perform work requiring a particularly high degree of accuracy or independent judgment; they may work from rough drafts which are difficult to read and which contain technical material, or they may plan and type complicated statistical tables, combine and rearrange materials from several different sources, or prepare master copies of material to be reproduced by photographic processes. A few specially trained typists operate teletypewriters, proportional spacing typewriters, and

other special kinds of typewriting machines.

Because many typists use special equipment or have jobs involving special duties, they also have special job titles. Thousands who combine typing with filing, sorting mail, answering the phone, and other general office work are called *clerk typists* (D.O.T. 209.588). Other much smaller groups of typists include *transcribing machine operators* (D.O.T. 208.588), who type letters and other documents as they listen to dictation recorded on tape or on sound-producing records; and *data typists* (D.O.T. 213.588) and *tape perforator operators* (D.O.T. 203.588), who use specially equipped electric typewriters to transfer coded instructions to magnetic or paper tapes for use in electronic computers. Still other typists having special duties and job titles include *policy writers* (D.O.T. 202.388) in insurance companies, *waybill clerks* (D.O.T. 209.588) in railroad offices, and *mortgage clerks* (D.O.T. 203.588) in banks.

Places of Employment

Almost 700,000 workers were employed as typists in 1970; over 95 percent were women. In addition, hundreds of thousands of workers in other kinds of clerical occupations also use typing skills in connection with their main job assignments.

Typists are employed in private and public enterprises of practically every kind—particularly in manufacturing firms, banks, insurance companies, and Federal, State, and local government agencies. Over one-half of all typists worked in such establishments in 1970.

Training, Other Qualifications, and Advancement

Many employers require applicants for typing positions to take a test to show their speed and accuracy. For most jobs, 40 to 50 words a minute is required. Typists also should have a good understanding of spelling, vocabulary, punctuation, and grammar.

Employers generally prefer to hire high school graduates. Business training, including the operation of office equipment, such as copying and adding machines, may be helpful. Also, the Federal Government sponsors training programs for unemployed and underemployed workers for entry positions as typists under provisions of the Manpower Development and Training Act.

Important aptitudes and personality traits for this occupation include finger dexterity, accuracy, neatness, a friendly personality, and the ability to concentrate in the midst of distractions. Transcribing machine operators should have good hearing.

A typist may be promoted from junior to senior typist or to other clerical work involving greater responsibility and higher pay. Typists who know shorthand may be promoted to stenographer or secretary.

Employment Outlook

Employment opportunities for typists are expected to be favorable through the 1970's. In addition to an anticipated rapid growth in employment, many thousands of additional openings will become available for workers to replace typists who retire or stop working for other reasons. Turnover in this field is high because many young women leave to care for their families.

As modern businesses continue to expand in size and complexity, more typists will be needed. However, duplicators increasingly will be used for routine typing and will limit demand for junior typists. The greatest demand will be for senior typists and for typists who can do other office work.

Earnings and Working Conditions

In 1970, the average monthly salary for beginning typists in metropolitan areas surveyed by the Bureau of Labor Statistics was $396 compared with $457 for experienced typists. Salaries varied considerably because of location, industry, and experience.

In the Federal Government, the entrance salary for beginning typists was $4,620 a year. Working conditions for typists usually are similar to those of other office workers in the firms where they are employed. (See introductory section of this chapter for information on Working Conditions and Sources of Additional Information.)

TELEPHONE OPERATORS

(D.O.T. 235.862)

Nature of the Work

Although millions of telephone calls are dialed each day without assistance, practically every telephone user sometimes makes a call that cannot be completed without help from the operator. Often the operator is asked to reverse charges on a long distance call, locate an individual, or indicate the cost of the call. Frequently the caller needs a correct number. The operator also may be needed to call the police in an emergency, assist a blind person who is unable to dial for himself, or arrange a conference which will enable business executives in different locations to confer by telephone.

These and many other services are provided by two groups of operators—those at switchboards in central offices of telephone companies; and those at private branch exchange (PBX) switchboards. Usually both operators insert and remove plugs attached to cords by manipulating keys and dials, and by listening and speaking into their headsets. Some switchboards are operated by pushbuttons or dials.

Central office operators are often contacted only when callers need assistance which is usually for long distance calls; for this reason, most central office operators are long distance operators. They obtain the information needed to complete the call, make the necessary connections and record the details of each call for billing. Many directory assistance operators (D.O.T. 235.862) also work in telephone companies; they provide telephone numbers by searching in telephone directories for numbers and addresses of new subscribers. Central office supervisors train new operators; they also aid in completing difficult calls. In each central office, all operators work under the direction of a chief operator.

PBX operators (D.O.T. 235-862) run switchboards which serve business offices and other establishments. In addition to connecting interoffice or house calls, they answer and relay outside calls, assist company employees in making outgoing calls, supply information to callers and record charges for switchboard calls. Duties of operators of PBX switchboards which serve dial telephones are similar to those of central office operators. In many small establishments, PBX operators work at switchboards which serve only a limited number of telephones. These operators do other office work such as typing or sorting mail. Many act as receptionists or information clerks. (The receptionist is described elsewhere in this chapter.)

Telephone operators use new equipment to handle long-distance calls.

Places of Employment

About 420,000 people were employed as telephone operators in 1970, approximately three-fifths as central office operators in telephone companies, and two-fifths as PBX operators in other types of establishments. Although employed in establishments of all kinds, a particularly large number of PBX operators worked in manufacturing plants, hospitals, schools, and department stores. Central office and PBX operators tend to be concentrated in heavily populated areas. Nearly one-fifth of the total were employed in the New York, Chicago, and Los Angeles metropolitan area. Practically all operators were women.

Training, Other Qualifications, and Advancement

In hiring beginners, employers prefer persons who have at least a high school education. English and business arithmetic provide good preparation. Since many jobs combine the switchboard and other office work, typing and commercial subjects also are helpful.

Young persons planning to become telephone operators should like to serve the public, be pleasant and courteous under all circumstances, and able to sit in a confined area. Rapid reading, a good memory, a pleasing voice, a good vocabulary, and good diction are important qualifications.

Although some schools have brief courses in switchboard operation, practically all new operators receive some on-the-job training to become familiar with the equipment, records, and work. In telephone company central offices operators first learn the procedures used to handle calls. Then they put through practice calls. After this instruction and practice—which usually lasts from 1 to 3 weeks—they are assigned to the regular operating force in a central office for further instructions in handling special types of calls not learned earlier.

PBX operators handling routine calls may have a somewhat shorter training period than central office operators. In a large business, a supervisor in the company's employ or an instructor from the local telephone company may train new employees. In a small establishment, an experienced operator usually supervises the training. The telephone operator's job is becoming less repetitive, largely because of the increasing use of direct dialing. Thus, public contacts make up an increasing proportion of their work. A high degree of eye-hand coordination and normal eyesight and hearing are helpful. Most telephone companies and many large business firms require applicants to pass physical examinations and general intelligence tests.

An experienced central office operator may be promoted to central office supervisor and, eventually, to chief operator. Promotion also may be to a clerical job or some other position within the telephone company. Similar opportunities exist for PBX operators in large firms; in many small businesses, however, opportunities for advancement are limited.

Employment Outlook

Employment of telephone operators is expected to rise slowly through the 1970's. An estimated 22,000 openings each year will be needed to replace central office and PBX operators who retire or stop working. Turnover is high, because most operators are young women who work a few years and then leave to care for families. Additional operators also will be needed to replace workers who transfer to other work.

Direct dialing and other changes have been under way for some years and have restricted growth in employment. At the same time, however, further increases are anticipated in the volume of calls. Consequently, little or no growth in employment is expected through the 1970's.

The number of PBX operators, on the other hand, is expected to rise throughout the 1970's. Employment in many PBX installations is expected to be relatively unaffected by further technological change. In some large PBX systems modern laborsaving equipment may be installed but its effect on employment should be more than offset by the number of new jobs created as more businesses require PBX services.

Earnings and Working Conditions

Central office operators in training averaged $2.16 an hour in December 1969, according to a Bureau of Labor Statistics survey: Experienced operators, $2.25; service assistants (central office supervisors), $3.15; and chief operators, $4.24. Salary levels varied in different sections of the country; they were highest in the Pacific States, where experienced operators averaged $2.66 an hour. Contracts between unions and telephone companies generally provide for periodic increases to operators. Central office operators usually receive extra pay for work on evenings, Sundays, and holidays.

The median weekly earning of Class A, PBX operators in metropolitan areas in February 1970 was $113; for Class B, PBX operators, the average was $91.

Earnings varied according to the industry in which PBX operators were employed and the section of the country. Average earnings were highest in public utilities and lowest in retail trade and services. By areas, earnings were highest in the West and lowest in the South.

The workweek for most central office and PBX operators averaged between 35 and 40 hours. Often, their scheduled hours are approximately the same as those of other clerical workers in the business community. In telephone companies, however, and in hotels, hospitals, and other establishments where telephone service is maintained on a 24-hour basis, operators usually work on shifts and on holidays and weekends. Some central office operators work split shifts—that is, they are on duty during the peak calling periods which occur in the late morning and early evening, and have time off between these two periods.

Operators in most telephone companies and other large establishments usually work in well-lighted and pleasant surroundings. Attractive lounges often are provided for relaxation during "breaks" in their scheduled hours. Insurance, pension, tuition plans and practices relating to paid holidays and vacations are much the same as those for other types of clerical employees.

Many operators employed by telephone companies are members of the Communications Workers of America and the Alliance of Independent Telephone Unions.

See the telephone industry chapter and introductory section of this chapter for sources of additional information.

SALES OCCUPATIONS

Saleswork offers career opportunities for young people who have not completed high school, as well as for those who have a college degree; for men and women who like to travel and those who do not; and for people who want salaried employment, as well as those who aspire to run their own businesses.

Workers in this occupational group may sell for manufacturers, insurance companies, and other producers of goods and services; for wholesalers who stock large quantities of goods so that smaller lots may be purchased and resold by retail stores; and for drugstores, dress shops, and other retailers who deal directly with the public.

About 4.9 million workers were employed in sales occupations in 1970. Approximately one-fourth were part-time employees who usually worked fewer than 35 hours a week. Two out of five were women, employed mainly in retail stores. In insurance, real estate, and other saleswork outside retail stores, the great majority of employees were men. Chart 20 shows employment in the major sales occupations discussed in this chapter. This chapter also includes individual statements for automotive salesworkers.

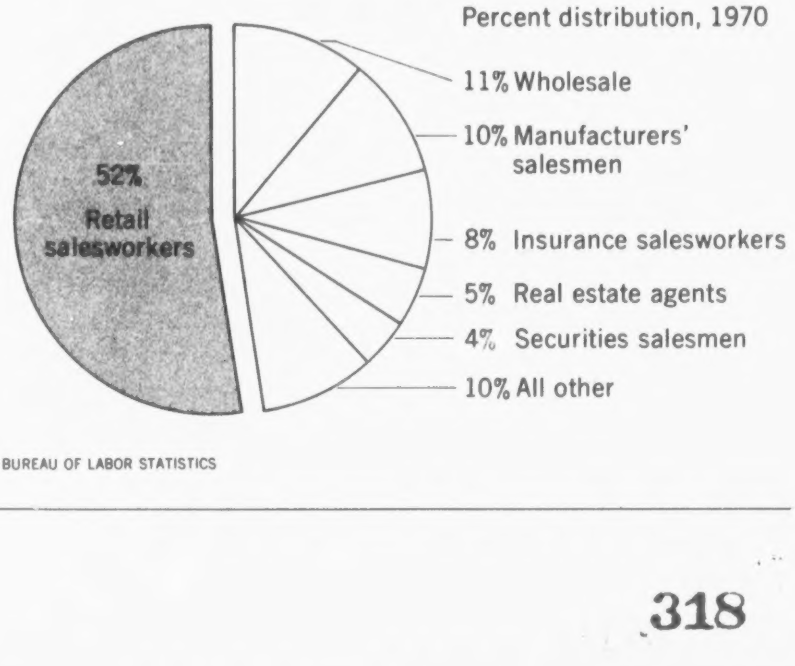
Training, Other Qualifications, and Advancement

Training requirements for different kinds of saleswork are as varied as the work itself. Thousands of salespersons have routine jobs selling standardized merchandise such as magazines, candy, cigarettes, and cosmetics. In such cases, the salesworker needs to do little more than "wait on" people who already have made their selections from the stock displayed. Employers seldom require salespeople in such jobs to have specialized training. They usually learn their duties on the job as they work with experienced salesclerks; in some large stores, they may attend brief training courses. Even in the most routine kinds of selling, however, a high school diploma is an asset to a beginner seeking a job. High school courses in business subjects, as well as specialized courses in distributive education offered in some school systems, are regarded by most employers as particularly good preparation for saleswork. The Federal Government also sponsors training for some salesworkers under provisions of the Manpower Development and Training Act.

The salesman who sells complex products or services—electronic equipment or liability insurance, for example—has a job which is altogether different from that of most retail salesclerks. Beginners on jobs of this kind sometimes receive training which lasts many months. For some positions, salesmen must be college graduates who have majored in engineering or some other field. Other salesmen dealing in specialized services and products may acquire the necessary technical knowledge through courses offered by universities or manufacturers. Still others gain knowledge through years of on-the-job experience, often supplemented by home study. Thus, a real estate salesman may qualify better for his job by taking university extension courses; a beauty counselor in a department store may participate in an industry-sponsored training program before beginning her sales duties; or a salesman of fine jewelry may acquire his knowledge of gems during years of observation and study as he works on the job.

Successful salespeople must have the ability to understand the needs and viewpoints of their customers, and a readiness to be of assistance to them. Saleswork also requires people with poise who are at ease in

⑳ Nearly 4.9 million workers are in sales occupations, about half in retail trade



SOURCE: BUREAU OF LABOR STATISTICS

dealing with strangers. Other important attributes in many types of selling are energy, self-confidence, imagination, the ability to communicate, and self-discipline. Because salesworkers frequently are required to make price computations or give customers change, arithmetic skills are an asset. In almost all saleswork, except retail stores, the salesman must have the initiative to locate his own prospective customers and plan his own work schedule.

Employment Outlook

During the 1970's, employment in sales occupations is expected to rise slowly. Openings created by employment growth as well as vacancies that arise as salesworkers retire, or stop working for other reasons, are expected to result in a need for a few hundred thousand workers each year. Additional workers will be needed to replace people now employed in saleswork who transfer to other types of employment.

As employment rises, the proportion of part-time workers—already higher than in most occupational groups—also is likely to increase. In the growing number of suburban shopping centers, where many retail stores remain open several nights a week, a larger-than-average proportion of the sales force is likely to be made up of part-time workers.

The main reason for the anticipated rise in employment is the prospect of increased sales resulting from population growth, business expansion and rising income levels. Within retail stores, however, special circumstances which have restricted employment growth in the recent past probably will continue to do so. Information about these special circumstances and the employment prospects for salesworkers in retail stores and other major fields is given in the sections which follow.

AUTOMOBILE PARTS COUNTERMEN

(D.O.T. 289.358)

Nature of the Work

Automobile parts countermen sell replacement parts and accessories for automobiles, trucks, and other motor vehicles. Most of them work in automobile parts wholesale stores and automobile dealerships, where they sell directly over the counter and take telephone orders for various items such as piston rings, head gaskets, shock absorbers, rearview mirrors, and seat covers.

Parts countermen employed by wholesalers sell parts for many makes of automobiles and trucks to independent repair shops, self-employed mechanics, service station operators, and "do-it-yourselfers." Parts countermen employed by dealers usually sell parts only for the particular makes of automobiles and trucks sold by the dealers. They may spend most of their time supplying parts to mechanics employed by the dealer.

A parts counterman identifies the item the customer needs—often only from general description—and locates it in the stockroom. By knowing parts catalogs and the layout of the stockroom he readily can find any one of several thousand items. If a customer needs a part that is not stocked, the parts counterman may suggest one that is interchangeable, place a special order, or refer the customer elsewhere.

The parts counterman determines the prices of parts from price lists, receives cash payment or charges the customer's account, fills out sales receipts and, when necessary, packages the item sold.

In addition to selling, parts countermen keep catalogs and price lists up to date, order parts to replenish stock, unpack and distribute incoming shipments in the stockroom, maintain sales records, and take inventories. In many large firms some of these nonselling duties are performed by other workers such as stock clerks and receiving clerks.

Parts countermen use micrometers, calipers, fan belt measurers, and other devices to measure parts for interchangeability. They also may use coil condenser testers, spark plug testers, and other testing equipment to determine if parts are defective. In some firms—particularly in small wholesale stores—they repair parts by using equipment such as brake riveting machines and brake drum lathes.

Places of Employment

Most of the estimated 68,000 automobile parts countermen employed in 1970 worked for automobile dealers and parts wholesalers. Most dealers employed 1 to 4 parts countermen; many wholesalers employed more than four. Other employers include truck dealers, retail automotive parts stores, automotive parts and accessories departments of department stores, and warehouse distributors of automotive parts. Trucking companies and buslines employ parts countermen to maintain stockrooms and dispense parts to the mechanics who repair their fleets.

Parts countermen work throughout the country in dealerships and automobile parts wholesale stores. Those who work for warehouse distributors, department stores, trucking companies, and buslines are employed mainly in large towns and cities.

Parts counterman identifies item in catalog.

Training, Other Qualifications, and Advancement

Automobile parts countermen should know the different types and functions of motor vehicle parts and have an aptitude for working with numbers. They should be neat, friendly, and tactful since they deal with many different types of customers. A good memory and the ability to write legibly and concentrate on details also are desirable qualifications. High school or vocational school courses in automobile mechanics, commercial arithmetic, salesmanship, and bookkeeping are helpful to young persons interested in becoming parts countermen. Practical experience from working in a gasoline service station or automobile repair shop, or working on cars as a hobby also is helpful. Employers generally prefer to hire high school graduates for entry jobs.

Most parts countermen learn the trade through informal on-the-job training. Beginners usually are hired as parts delivery men or trainees. In some large firms beginners start as stock or receiving clerks. Trainees gradually learn the different types of parts, the use of catalogs and price lists, and the layout of the stockroom. Although trainees may wait on customers after a few months' experience, generally about 2 years are required to become a qualified parts counterman.

Training programs for unemployed and underemployed workers for entry jobs as parts countermen are in operation in several cities under the Manpower Development and Training Act. Persons who complete these programs, which usually last up to a year, may need additional on-the-job training to become fully qualified.

Parts countermen who have supervisory and business management ability may become parts department or store managers. Others may become "outside salesmen" for parts wholesalers and distributors. These salesmen call on automobile repair shops, service stations, trucking companies, and other businesses that buy parts and accessories in large quantities. Some parts countermen establish their own automobile parts stores.

Employment Outlook

Employment of automobile parts countermen is expected to increase moderately through the 1970's. In addition to the job opportunities resulting from employment growth, more than a thousand job openings are expected annually to replace experienced workers who retire or die. Job openings also will occur as some parts countermen transfer to other occupations.

Employment is expected to increase to maintain the increasing number of motor vehicles in use. Moreover, the variety of parts is growing because automobile manufacturers are producing a greater selection of makes, models, and optional equipment. As a result, automobile dealers and parts wholesalers are selling a larger variety of parts, although many parts are interchangeable.

Earnings and Working Conditions

Automobile parts countermen are paid a weekly or monthly salary, or an hourly wage rate. In addition, they may receive commissions on sales. Parts countermen employed by automobile dealers in 34 cities had average straight-time hourly earnings of $3.40, based on a survey in late 1969. Averages ranged from $2.48 in Richmond, Va., to $4.66 in San Francisco–Oakland, Calif.

Most parts countermen work between 40 and 48 hours a week. In many firms, they work half a day on Saturday.

Many employers provide paid holidays and vacations, and pay part or all of additional benefits such as life, health, and accident insurance. Others also contribute to retirement plans.

Stockrooms usually are clean and well lighted. The work is not physically strenuous, but parts countermen spend much of their time standing or walking. They frequently have to work rapidly when waiting on more than one customer and simultaneously answering telephone calls.

Many parts countermen belong to the following unions: the International Association of Machinists and Aerospace Workers; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.).

Sources of Additional Information

For further information on employment opportunities, inquiries should be directed to local automobile dealers and parts wholesalers, locals of the unions previously mentioned, or the local office of the State employment service. The State employment service also may be a source of information about the Manpower Development and Training Act and other training programs.

General information about the work of automobile parts countermen may be obtained from:

Automotive Service Industry Association, 230 North Michigan Ave., Chicago, Ill. 60601.

National Automotive Parts Association, 29 East Madison St., Chicago. Ill. 60602.

AUTOMOBILE SALESMEN

(D.O.T. 280.358)

Nature of the Work

Automobile salesmen are important links between dealers and car buyers. Many salesmen sell only new or used cars. Others, particularly those employed in small dealerships, sell both new and used cars, as well as trucks. (This statement does not discuss salesmen who sell trucks only.)

The automobile salesman spends much of his time waiting on customers in the showroom or used-car lot. After greeting a customer, he determines the kind of car the customer wants by asking questions and encouraging comments about cars on display. For example, one customer may be interested primarily in economy and ease of operation, but another may be more impressed with styling and performance. The salesman emphasizes the points that satisfy the customer's desires and stimulate his willingness to buy. To illustrate features such as smoothness of ride and ease of operation, he invites the customer to test drive the car.

Because the purchase of a car involves a considerable sum of money, many customers must be convinced that they are making a wise decision. Successful salesmen have ability to overcome the customer's hesitancy to buy, and get the order (called closing the sale). Since closing the sale frequently is difficult for beginning salesmen, experienced salesmen or sales managers often lend assistance. Salesmen may quote tentative prices and trade-in allowances when conferring with customers, but these figures usually are subject to the approval of sales managers. Salesmen may arrange financing and insurance for the cars they sell. They also register cars and obtain license plates.

Before the salesman approves delivery, he makes sure the car has been serviced properly and has the accessories specified by the customer. He answers the customer's questions on subjects such as the car's controls and the maintenance warranty. Following delivery of the car, he may contact the customer by phone or mail to express apprecia-

Automobile salesman discusses new car features with customer.

tion for his business and to inquire about his satisfaction with the car. From time to time, he also may send brochures on new-car models and other literature. By keeping in contact with his customers, the salesman builds repeat business.

Salesmen develop and follow leads on prospective customers. For example, they obtain names of prospects from automobile registration records and dealer sales, service, and finance records. A salesman also can obtain leads from gasoline service station operators, parking lot attendants, and others whose work brings them into frequent contact with people. He may contact prospects by phone or mail.

Places of Employment

An estimated 120,000 automobile salesmen were employed in 1970. More than four out of every five were employed by new-car dealers, many of whom also sell used cars. The remainder worked for used-car dealers. Although many used-car dealers employ only 1 salesman, a few new-car dealers employ more than 50 salesmen. Some used-car dealers do not employ full-time salesmen.

Automobile salesmen are employed throughout the country, although most work in large urban areas and in the most populous States.

Training, Other Qualifications, and Advancement

Most beginners are trained on the job by sales managers and experienced salesmen. Many large dealers also provide several days of classroom training on obtaining customer leads, making sales presentations, and closing sales. Beginners frequently are given training manuals and other educational material published by automobile manufacturers. Experienced and beginning salesmen receive continuing guidance and training from sales managers, both on the job and at periodic sales meetings. Salesmen also may attend training programs offered by automobile manufacturers.

Most sales managers regard a high school diploma as the minimum educational requirement for beginning automobile salesmen. Many automobile salesmen have additional education. Courses in public speaking, commercial arithmetic, English, business law, psychology, and salesmanship provide a good background for selling. Previous sales experience or work requiring contact with the public is helpful. Many automobile salesmen previously have been furniture salesmen, route salesmen, door-to-door salesmen, automobile parts countermen, or gasoline service station attendants. However, many sales managers will hire inexperienced applicants who have satisfactory personal and educational qualifications.

Although age requirements for beginning salesmen vary, many employers prefer applicants who are at least in their mid- or late twenties. Age requirements may be waived if the employer considers the applicant to be mature. However, most employers consider 21 the minimum age for beginning salesmen.

Automobile salesmen must be tactful, well-groomed, able to express themselves well, and have other personal qualities that make a good impression on customers. Initiative and aggressiveness also are important because the volume of sales usually is related to the number of prospective customers contacted. Because automobile salesmen occasionally work for days without making a sale, they need self-confidence and determination to get through these slow periods.

Successful salesmen who have managerial ability may advance to assistant sales manager, sales manager, or general manager. Some sales managers and general managers open their own dealerships or become partners in dealerships.

Employment Outlook

The number of automobile salesmen is expected to increase moderately through the 1970's. In addition to openings resulting from employment growth, a few thousand openings will occur each year to replace salesmen who retire or die. Many openings also will arise as salesmen transfer to other occupations. Although selling cars is rewarding for many people, others leave to seek new jobs because they are not suited for the work.

Employment of automobile salesmen will increase primarily because car sales will grow as population, multicar ownership, and personal income increase. Car sales generally fluctuate from year to year as a result of changes in general business conditions, consumer preferences, and the availability of credit. Employment of automobile salesmen also fluctuates, but tends to be more stable than sales.

Earnings and Working Conditions

Most automobile salesmen are paid a commission based on the selling price of a car or the gross profit received by the dealer. Additional commissions may be paid when cars are financed and insured through the dealer. Although salesmen work year-round, their sales (and their commissions) vary from month to month. To provide commissioned salesmen with a steady income, many dealers pay a modest weekly or monthly base salary. Others advance salesmen money against future commissions. A few dealers pay salesmen a straight salary. Dealers may guarantee beginners a modest income for a few weeks or months. Thereafter, they are paid on the same basis as experienced salesmen.

Automobile salesmen had average weekly earnings of $193 in 1969, according to information from the National Automobile Dealers Association. Earnings varied considerably, depending on individual ability and experience, geographic location, dealership size, and other factors. For example, salesmen employed by dealers that sold between 100 and 149 vehicles annually had average weekly earnings of $143, while those employed by dealers that sold 1,000 or more had average weekly earnings of $234.

A large number of employers furnish salesmen with demonstrator cars free of charge. Others allow salesmen to buy or lease them at a discount, often at dealer's cost. Salesmen also receive discounts on cars bought for their personal use. Most dealers provide paid vacations. Many provide life insurance, hospitalization, and surgical and medical insurance.

Because most customers find shopping after work convenient, salesmen frequently work during the evenings. In some areas, they may work on Sundays and take a day off during the week. Many dealers assign salesmen "floortime"—hours they spend in the showroom greeting customers. For example, a salesman may be scheduled to work on the showroom floor from 9 a.m. to 3 p.m. one week, from 3 p.m. to 9 p.m. the next week, and all day on Saturdays. When not assigned to the floor, salesmen may spend a few hours each day delivering cars to customers and looking for new customers.

Sources of Additional Information

Information on employment opportunities may be obtained from local automobile dealers or the local office of the State employment service. General information about the work of automobile salesmen may be obtained from:

National Automobile Dealers Association, 2000 K St. NW., Washington, D.C. 20006.

AUTOMOBILE SERVICE ADVISORS

(D.O.T. 620.281)

Nature of the Work

Many automobile dealers and some large independent garages employ service advisors to wait on customers who bring their automobiles for maintenance and repairs. The service advisor (sometimes called *service salesman* or *service writer*) confers with the customer to determine his service requirements and arranges for a mechanic to perform the work.

When a routine checkup is requested, the advisor merely writes the customer's requests on a repair order. However, when the customer complains of mechanical or electrical trouble, the service advisor asks about the nature of the trouble and may test drive the automobile. For example, if the customer says his automobile is difficult to start, the service advisor may try to determine if this occurs when the engine is cold or after it has warmed up. He writes a brief description of these symptoms on the repair order to help the mechanic locate the cause of the trouble. The advisor also records other information on the repair order, including identification of the customer and his automobile. If the repairs are covered by a factory warranty, he records the automobile engine and body numbers, and the automobile's mileage and purchase date.

The service advisor tells customers what repairs are needed, their approximate cost, and how long the work will take. He may advise on the necessity of having work done, by pointing out that it will assure improved performance, safer operation, and prevent more serious trouble. In addition to advising customers on service needs, he may sell accessories such as air-conditioners or radios.

If the service advisor is unable to tell the customer what repairs are needed until a mechanic has inspected the automobile, he records the customer's phone number and contacts him later to obtain permission to perform the repairs.

The service advisor gives the repair order to the shop dispatcher who in turn usually computes the cost of repairs and assigns the work to a mechanic. In some shops, service advisors may compute the cost of repairs. If the mechanic has questions about the repair order, he contacts the service advisor. After the mechanic has completed the repair work, the service advisor may test drive the automobile to be

SERVICE CENTER

Automobile service advisor listens to customer's description of automobile trouble.

sure the problem has been corrected.

When the customer returns for his automobile, the service advisor answers questions regarding the repairs and settles complaints about their cost or quality. If the automobile is to be returned to the shop because the customer is dissatisfied, or the cost of repairs is to be adjusted, the service advisor usually must obtain the authorization of his supervisor, the service manager. In some dealerships, the most experienced service advisor substitutes for the service manager when he is absent.

Places of Employment

An estimated 20,000 automobile service advisors were employed in 1970. Most of them worked for large automobile dealers that employed from one to four service advisors. Few small automobile dealers employ service advisors. Some service advisors are employed by large independent automobile repair shops.

Training, Other Qualifications, and Advancement

Service advisors are trained on the job under the guidance of experienced service advisors and the service manager. In many shops, the trainee's first assignment is to assist the service department dispatcher or cashier. By working with the dispatcher, he learns how repair orders are routed through the shop, how long it takes to complete different types of repairs, and how to compute repair costs. At the cashier's counter he learns the cost of different types of repairs. He also learns how experienced service advisors handle customer complaints. The beginner usually can become a qualified service advisor in 1 to 2 years, although it may take longer if his duties include estimating automobile body repairs. In addition to on-the-job training, some service advisor trainees attend formal training programs conducted by automobile manufacturers.

For service advisor trainees, employers prefer high school graduates who are over 21 years of age and have work experience in automobile repair or related activities. Employers usually promote young persons from within their own organizations when vacancies for service advisor trainees arise. For example, a young person may apply for a job as service advisor trainee after he has gained experience in the firm as an automobile mechanic trainee or parts counterman trainee. Some firms, however, prefer to hire individuals who are qualified automobile mechanics.

Because he is likely to be the only employee who deals directly with customers, the manner in which the service advisor does his job is very important in establishing customer satisfaction. Therefore, employers look for applicants who are neat, courteous, even-tempered, attentive listeners, and good conversationalists. High school and vocational school courses in automobile mechanics, commercial arithmetic, salesmanship, public speaking, and English are helpful to young persons interested in becoming service advisors.

Service advisors with supervisory ability may advance to shop foremen or to service managers. Some service advisors open their own automobile repair shops.

Employment Outlook

Employment of automobile service advisors is expected to increase moderately through the 1970's as a result of the increasing number of automobiles in operation. In addition to the job opportunities resulting from employment growth, a few hundred job openings are expected each year from the need to replace experienced service advisors who retire, die, or transfer to other occupations.

The number of automobiles registered in the United States is expected to grow because of increases in driving age population, consumer purchasing power, and multicar ownership. The growing number of automobiles and their increasing complexity will result in additional repair work; consequently, many automobile dealers will need additional service advisors. Also, some small dealers who presently do not employ service advisors are expected to hire them as the volume of service work increases.

Earnings and Working Conditions

Service advisors employed by automobile dealers in 34 cities had average straight-time hourly earnings of $4.38, based on a survey made in late 1969. Average hourly earnings in individual cities ranged from $3.06 in Richmond, Va., to $5.59 in Los Angeles, Calif.

Many service advisors are paid a salary plus a commission. The commission usually is based on both the cost of repairs and the price of accessories sold. Some service advisors are paid on a straight commission basis. Commission earnings may vary as a result of fluctuations in the volume of repair work.

Many employers provide paid holidays and vacations, and pay all or part of the cost of life insurance, and health and accident insurance. Others also contribute to retirement plans. Laundered uniforms are furnished free of charge by many employers.

Most service advisors work from 40 to 48 hours a week. They are busiest in the early morning when most customers bring their cars for repairs, and in late afternoon when they return. During these peak hours, some advisors may be rushed when waiting on customers.

Service advisors stand much of the time and may be outdoors in all kinds of weather. Their work is not physically strenuous. Occasionally, they have to deal with disgruntled customers, but most customers are pleasant.

Unions that organize service advisors include the International Association of Machinists and Aerospace Workers; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.).

Sources of Additional Information

Further information on employment opportunities may be obtained from local automobile dealers or repair shops; locals of the unions previously mentioned; or the local office of the State employment service.

General information about the work of automobile service advisors may be obtained from:

Automotive Service Industry Association, 230 North Michigan Ave., Chicago, Ill. 60601.

Independent Garage Owners of America, Inc., 624 South Michigan Ave., Chicago, Ill. 60605.

INSURANCE AGENTS AND BROKERS

(D.O.T. 250.258)

Nature of the Work

Insurance agents and brokers sell policies which protect individuals and businesses against future losses and financial pressures. They also provide their customers with many services related to the insurance they sell. They may, for example, assist in planning the financial protection which best meets the special needs of a customer's family; advise about the types of insurance best suited for the protection of an automobile, home, business establishment, or other property; or help a policyholder in obtaining settlement of an insurance claim.

Three basic types of insurance are available—life, property and liability, and health. Agents and brokers usually sell one or more of these types of insurance. Some agents also sell equity products, such as mutual fund shares. Life insurance policies pay survivors in the event of the policyholder's death; they also may provide annuities, funds for the education of children when they reach college age, and other benefits which the policyholder has arranged in anticipation of a future need for these funds. Property and liability insurance policies protect policyholders from financial losses which they might otherwise incur because of automobile accidents, fire and theft, or other hazards. Health insurance policies offer protection against the costs of hospital and medical care or loss of income due to an illness or injury.

An insurance agent may be either an insurance company employee or an independent businessman who is under contract to act as the authorized representative of one insurance company or more. A broker occupies a somewhat different position; he is not under contract to any particular company but places the policies he sells with whatever insurance company he feels best meets his clients' needs. In other respects, agents and brokers do much the same kind of work.

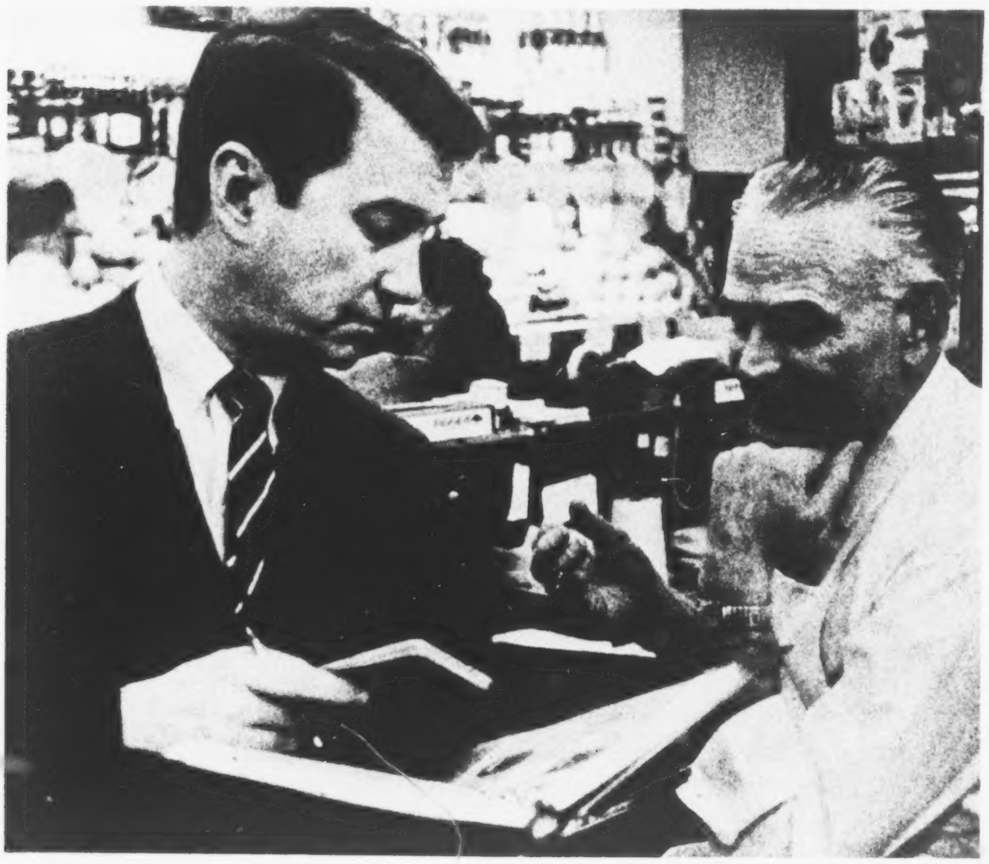
Agents and brokers spend most of their time discussing insurance policies with prospective customers. Some time must be spent in office work—planning insurance programs that are tailored to prospects' needs, preparing reports, maintaining records, and drawing up lists of prospective customers. Salesmen who specialize in group policies may help to incorporate an insurance program into a company's bookkeeping system.

(See chapter on Insurance Occupations for additional information about life and property and liability insurance companies.)

Places of Employment

Of the 350,000 agents and brokers who sold insurance in 1970, about half specialized in life insurance; the remainder, in property and liability insurance. Both groups also sold health insurance. Nine out of ten agents and brokers were men. Many additional agents—both men and women—sold insurance on a part-time basis.

Insurance agents and brokers are employed in all parts of the country, but the greatest number work in large cities.



Training, Other Qualifications, and Advancement

Although employers seldom specify age limits or formal educational requirements, practically all agents hired in recent years have been at least 21 years of age, and more than half of them have had some college training. Many were college graduates. College training, although not essential, may be an aid to the agent in grasping insurance fundamentals and in establishing good personal relationships with prospective clients. Courses in accounting, economics, finance, and business law, as well as courses in insurance subjects, are considered helpful. A liberal arts curriculum is equally desirable in preparing the prospective agent.

Because an agent's or broker's success depends on his sales ability, he must have the initiative to locate new prospects. He also must know insurance fundamentals and be able to explain policy terms clearly. Enthusiasm, self-confidence, and a cheerful personality are valuable.

All insurance agents and most brokers must obtain licenses in the States where they plan to sell insurance. In most States, licenses are issued only to applicants who pass written examinations covering insurance fundamentals and the State insurance laws.

Before new agents sell they usually receive training at insurance company home offices or at the agencies and brokerage firms where they will be working. Some insurance companies sponsor classes in sales problems and insurance principles. This instruction may be given over a period of several weeks or a few months. In other cases, training takes the form of working on the job under the supervision of experienced sales personnel.

Agents and brokers have opportunities to broaden their knowledge of the insurance business by enrolling in intermediate and advanced courses available at many colleges and universities and by attending institutes, conferences, and seminars sponsored by insurance organizations. The Life Underwriter Training Council (LUTC) offers courses in life and health insurance for experienced life agents. A diploma in life insurance marketing is awarded to graduates who successfully complete the Council's 2-year life program. As an agent or broker acquires experience and broadens his knowledge of the life insurance business, he can qualify for the designation Chartered Life Underwriter (CLU) by passing a series of examinations given by the American Society of Chartered Life Underwriters. In much the same way, a property and liability agent, by passing an examination given by the American Institute for Property and Liability Underwriters, Inc., will qualify for the Chartered Property Casualty Underwriter (CPCU) designation. The CLU and CPCU designations are recognized marks of achievement in their respective fields.

Insurance agents who demonstrate sales ability and leadership may be promoted to sales manager positions in district offices or to managerial positions in home offices. A few may advance to top positions as agency superintendents or company vice-presidents or presidents. Many agents who have built up a good clientele prefer to remain in sales work. Some, particularly in the property and liability field, eventually establish their own independent agencies or brokerage firms.

Employment Outlook

Several thousand openings for insurance agents and brokers are expected to arise each year through the 1970's. Some will be new jobs created as employment expands; others will become available as agents and brokers retire or stop working for other reasons. Because the rate of turnover is high among beginners in this occupation, many workers also will be needed to replace insurance agents who enter other types of employment.

During the 1970's, the number of insurance agents and brokers is expected to grow moderately. As population and incomes rise and life expectancy increases, more families will depend on life insurance and on policies that provide protection in the form of retirement income, medical care, and funds for a college education. Expansion in industrial plant and equipment and growth in the number of major consumer purchases, such as homes or automobiles, will contribute to increased sales of property and liability insurance. Despite the expected increase in the number of policies issued, however, insurance selling will remain keenly competitive as more insurance is sold to groups or by mail and as electronic data processing relieves agents of clerical tasks.

Earnings and Working Conditions

Beginners in this occupation often are guaranteed moderate salaries or advances on commissions while they are learning the business and building up a clientele. Thereafter, most agents are paid on a commission basis. The size of the commission varies, depending on the type and amount of insurance sold, and on whether the transaction involves a new policy or the renewal of a policy already in force. After a few years, an agent's commissions on new policies sold and on renewals may range from $8,000 to $20,000 annually. A number of established and highly successful agents and brokers earn $30,000 a year or more.

Agents and brokers generally pay their own automobile and traveling expenses. In addition, those who own and operate independent businesses must pay office rent, clerical salaries, and other operating expenses out of their earnings.

Although insurance agents usually are free to arrange their own hours of work, they often schedule appointments during evenings and weekends for the convenience of clients. Some agents spend more than the customary 40 hours a week on the job.

Sources of Additional Information

General occupational information about insurance agents and brokers may be obtained from the home office of many life insurance and property and liability insurance companies. Information on State licensing requirements may be obtained from the department of insurance at any State capital.

Information about a career as a life insurance agent also may be obtained from:

Institute of Life Insurance, 277 Park Ave., New York, N.Y. 10017.

Life Insurance Agency Management Association, 170 Sigourney St., Hartford, Conn. 06105.

The National Association of Life Underwriters, 1922 F St., NW., Washington, D.C. 20006.

Information about sales training in life and health insurance is available from:

The Life Underwriter Training Council, 1922 F St., NW., Washington, D.C. 20006.

Information about property and liability agents and brokers can be obtained from:

Insurance Information Institute, 110 William St., New York, N.Y. 10038.

National Association of Insurance Agents, Inc., 96 Fulton St., New York, N.Y. 10038.

MANUFACTURERS' SALESMEN

(D.O.T. 260. through 289.458)

Nature of the Work

Practically all manufacturers—whether they make electronic computers or can openers—employ salesmen. Manufacturers' salesmen sell mainly to other businesses—factories, railroads, banks, wholesalers, and retailers. They also sell to hospitals, schools, and other institutions.

Most manufacturers' salesmen sell nontechnical products. Salesmen in this kind of work must be well informed about their firms' products and also about the special requirements of their customers. When a salesman visits firms in his territory, he uses an approach adapted to his particular line of merchandise. Thus, a salesman of crackers or cookies emphasizes the wholesomeness of his products, their attractive packaging, and the variety. Sometimes salesmen promote their products by displays in hotels and conferences with wholesalers and other customers.

A salesman of highly technical products, such as electronic equipment, often is called a *sales engineer* or an *industrial salesman*. In addition to having a thorough knowledge of his firm's products, he must be able to help prospective buyers with technical problems. For example, he may spend days or weeks analyzing a firm's manufacturing problems to determine the kinds of equipment and materials best suited to its operation. He then presents his solution to company officials and tries to negotiate the sale. Often, sales engineers work with the research and development departments of their own companies in devising ways to adapt products to a customer's specialized needs. Salesmen of technical products sometimes train their customers' employees in the operation and maintenance of new equipment, and make frequent return visits to be certain that it is giving the desired service.

Although manufacturers' salesmen spend most of their time visiting prospective customers, they also do some paperwork including reports on sales prospects in their territories or customers' credit ratings. In addition they must plan their work schedules, compile lists of prospects, make appointments, conduct some sales correspondence, and study literature relating to their products.

Places of Employment

Over 500,000 manufacturers' salesmen were employed in 1970; about 45,000 were sales engineers. Some manufacturers' salesmen work out of home offices, often located at manufacturing plants. The majority, however, work out of branch offices, usually in big cities near prospective customers.

More salesmen work for companies that produce food products than for any other industry. Other industries that employ large numbers of salesmen include printing and publishing, chemicals, fabricated metal products, and electrical and other machinery. The largest employers of sales engineers produce heavy machinery, transportation equipment, fabricated metal products, and professional and scientific instruments. About 10 percent of all manufacturers' salespeople are women, most of whom are employed in industries producing food products.

Training, Other Qualifications, and Advancement

Although high school graduates can be successful manufacturers' salesmen, college graduates increasingly are preferred as trainees.

Manufacturers of nontechnical products often prefer college graduates who have a degree in liberal arts or business administration. Training at a college of pharmacy usually is required for jobs as drug salesmen. A salesman of complicated equipment needs a technical education. For example, manufacturers of electrical equipment, heavy machinery, and some types of chemicals prefer to hire college-trained engineers or chemists. (Information on chemists, engineers, and other professionally trained workers who may be employed as manufacturers' salesmen is presented elsewhere in the *Handbook*.)

Although many prospective salesmen are hired at the sales offices of manufacturing concerns, representatives of manufacturers sometimes recruit college seniors who are well qualified academically and have participated in extra-curricular activities. A pleasing personality and appearance and the ability to meet and get along well with many types of people are important. Since salesmen may have to walk or stand for long periods of time or carry product samples, physical stamina is necessary. As in most selling jobs, arithmetic skills are an asset.

Beginning salesmen are given specialized training before they start on the job. Some companies, especially those manufacturing complex technical products, have formal training programs lasting 2 years or longer. In some of these programs, trainees are rotated among jobs in several departments of the plant and office to learn all phases of production, installation, and distribution of the product. Other trainees receive formal class instruction at the plant, followed by intensive on-the-job training in a branch office under the supervision of field sales managers.

Sales representatives who have good sales records and leadership ability may advance to sales supervisors, branch managers, or district managers. Those having managerial skill eventually may advance to sales manager or other executive positions; many top executive jobs in industry are filled by men who started as salesmen.

Because of frequent contact with businessmen in other firms, salesmen often transfer to better jobs. Some salesmen go into business for themselves as manufacturers' agents selling similar products of several manufacturers. Experienced salesmen often find opportunities in advertising, market research, and other fields related to selling.

Employment Outlook

Employment opportunities for manufacturers' salesmen are expected to be favorable during the 1970's. Several thousand openings will occur annually as employment in this occupation rises and as existing jobs become vacant because of retirements or deaths. Still other vacancies will occur as salesmen leave their jobs to enter other types of employment.

The number of manufacturers' salesmen is expected to rise moderately due to general economic growth and the greater emphasis manufacturers will be placing on their sales activities. The development of new products and improved marketing techniques probably will heighten competition among the manufacturers. Because of the increase in the volume of business transacted with some customers—modern industrial complexes, chain store organizations, and large institutions of many kinds—competition among the manufacturers supplying these organizations will intensify the need for effective sales organizations. Despite the filling of thousands of sales jobs each year, manufacturers are expected to be selective in hiring. They will look for ambitious young people who are both well trained and temperamentally suited for their jobs. As markets for technical products expand, demand for trained salesmen is likely to be particularly strong.

Earnings and Working Conditions

According to limited data, starting salaries for beginning salesmen averaged about $8,500 a year in 1970. By including commissions and bonuses most salesmen earned more than this amount annually. The highest starting salaries generally were paid by manufacturers of electrical and electronic equipment, construction materials, hardware and tools, and scientific and precision instruments.

Some manufacturing concerns pay experienced salesmen a straight commission, based on their dollar amount of sales; others pay a fixed salary. The majority, however, use a combination plan: salary and commission, salary and bonus, or salary-commission and bonus. Commissions vary according to the salesman's efforts and ability, the commission rate, location of his sales territory, and the type of product sold. Bonus payments may be contingent upon the individual salesman's performance, that of all salesmen in his group or district, or upon the company's sales performance. Some firms pay annual bonuses; others offer them as incentive payments on a quarterly or monthly basis. In 1970, many experienced salesmen earned between $16,000 and $32,000 annually; some earned considerably more.

Some manufacturers' salesmen have large territories and do considerable traveling. Others usually work in the neighborhood of their "home base." For example, a salesman of heavy industrial equipment may be assigned a territory covering several States and often may be away from home for days or weeks at a time. On the other hand, a salesman of food products may work in a small area and commute from home.

When on business trips, salesmen are reimbursed for expenses such as transportation and hotels. Some companies provide a car or pay a mileage allowance to salesmen who use their own cars.

Salesmen call at the time most convenient to customers and may have to travel at night or on weekends. Frequently, they spend evenings writing reports and planning itineraries. However, some salesmen plan their schedules for time off when they want it. Most salesmen who are not paid a straight commission receive 2 to 4 weeks' paid vacation, depending on their length of service. They usually share in company benefits, including life insurance, pensions, and hospital, surgical, and medical benefits.

Sources of Additional Information

For more information on the occupation of manufacturers' salesman, write to:

Sales and Marketing Executives International, Student Education Division, 630 Third Ave., New York, N.Y. 10017.

REAL ESTATE SALESMEN AND BROKERS

(D.O.T. 250.358)

Nature of the Work

Real estate salesmen and brokers are at the center of most property transactions. They represent property owners who want to sell and find potential buyers for residential and commercial properties. Salesmen and brokers also may be called *real estate agents,* or if they are members of the National Association of Real Estate Boards, *"Realtors."*

Salesmen are employed by brokers to show and sell real estate; some handle rental properties. Brokers are independent businessmen who not only sell real estate but sometimes rent and manage properties, make appraisals, arrange for loans to finance purchases, and develop new building projects. In addition, brokers manage their offices, advertise properties, and handle other business operations. Some combine other work, such as selling insurance or practicing law, with their real estate business.

Most real estate salesmen and brokers sell residential property, and sometimes specialize in homes within a certain price range or in a particular area of the city. A few, usually those in large real estate firms, specialize in commercial, industrial, or other types of real estate. Each specialty requires knowledge of the particular type of property. For example, salesmen who specialize in commercial sales or leasing must understand leasing practices, business trends, and location needs. Salesmen selling or leasing industrial properties must be able to supply information on transportation, utilities, and labor supply. Salesmen who handle farm properties must have considerable knowledge of soil types, water supply, drainage, and transportation facilities.

An important duty of a real estate salesman is obtaining "listings" (getting owners to place properties for sale with the firm). A salesman spends much time on the telephone, seeking such listings and answering inquiries about properties. He obtains leads for listings through advertising and personal contact.

A real estate salesman spends much time away from his office showing and discussing properties with prospective buyers. When a number of houses are for sale in a new development, the salesman may operate from a model home. He explains special features which meet particular needs of the prospective buyer (or renter) such as location of schools and churches and public transportation. For business property, he may discuss the income potential, zoning, and community facilities. He also must be familiar with tax rates and insurance. He must try to meet the buyer's needs at the same time that he follows the seller's instructions. In closing the sale, the broker often arranges for a loan, title search, and a meeting when details of the transaction are agreed upon and the new owner takes possession of the property.

Places of Employment

The number of people whose main occupation was selling real estate in 1970 is estimated at about 225,000; about three-fifths were men. A large number of people also sold real estate part time. The total number of men and women licensed to sell was more than 900,000 in 1969, according to the National Association of Real Estate License Law Officials.

Most real estate salesmen work for small business establishments; a few, in metropolitan areas, work for firms having large sales staffs. Brokers generally are self-employed. Although salesmen and brokers are found in every part of the country, they are concentrated in large urban areas and in smaller but rapidly growing communities.

Training, Other Qualifications, and Advancement

A license is required to work as a real estate salesman or broker in every State and in the District of Columbia. All States require prospective agents to pass written examinations that generally include questions on the fundamentals of real estate transactions and on laws affecting the sale of real estate. The examination is more comprehensive for brokers than for salesmen. In more than three-fifths of the States, candidates for the broker's license also must have a specified amount of experience as a real estate salesman or the equivalent in related experience or education (generally from 1 to 3 years). State licenses usually can be renewed annually without reexamination.

Although a specified amount of education seldom is required, employers prefer to hire persons who have at least a high school education. A broad academic program in high school including courses such as English, mathematics, salesmanship, architectural drawing, business law, economics, and public speaking is helpful for those planning a career in real estate. Most real estate agents have some college training and many are college graduates. College courses in real estate subjects as well as psychology, economics, finance, and business administration are an asset.

Characteristics important for success in selling real estate include a pleasing personality, honesty, and a neat appearance. Dealing with prospective customers requires maturity and tact as well as enthusiasm for the job. Agents also should have a good memory for names and faces and business details such as prices and zoning regulations.

Young men and women interested in beginning jobs as real estate salesmen often apply to brokers in their own communities, where their knowledge of local neighborhoods is an advantage. The beginner usually works under the direction of an experienced salesman or broker to learn the practical aspects of his job.

Training opportunities are available for beginners and experienced agents; many firms offer formal training programs for salesmen. At some of the more than 360 universities, colleges, and junior colleges which offer courses in real estate, a student can earn an associate's or bachelor's degree with a major in real estate; some offer advanced degrees. Many local real estate boards that are members of the National Association of Real Estate Boards (NAREB) sponsor courses in subjects such as real estate fundamentals and legal aspects of real estate. Advanced courses in appraisal, mortgage financing, and property development and management also are available through various NAREB affiliates.

Salesmen who have experience and training can advance in many large firms to sales or general manager. Licensed brokers may open their own offices. Training and experience in estimating the value of property can lead to work as a real estate appraiser. Persons familiar with operating and maintaining rental properties may specialize in property management. Those who gain wide general experience in real estate and a thorough knowledge of business conditions and property values in their localities may enter mortgage financing or real estate counseling.

Employment Outlook

Several thousand openings for real estate salesmen are expected to arise each year during the 1970's. Some will be new positions created by the need for more salesmen to serve a growing population. Most, however, will be openings resulting from turnover. Because the average age of real estate salesmen and brokers is considerably higher than that of workers in most occupations, death and retirement losses are high. In addition, a relatively large number of agents—many of them beginners—transfer to other types of work.

Many openings are likely to be filled by mature workers, including persons who transfer from other kinds of sales work. The proportion of salesmen employed part time may decline, as State licensing requirements change and more specialized knowledge is necessary for the agent who handles real estate transactions.

Employment of real estate salesmen and brokers is expected to rise moderately during the 1970's, when the many young people born after World War II will be purchasing or renting their own homes. Among other factors contributing to a growing need for agents are the expected expansion in residential and commercial construction due to an increasing population, migration to metropolitan areas, and urban renewal. Although this field is likely to remain highly competitive, it should offer many career opportunities to persons with an aptitude for selling.

Earnings and Working Conditions

Commissions on sales are the usual source of earnings for most real estate salesmen and brokers. A few are paid on a straight salary basis, although this is the exception rather than the rule. Commissions paid on the sale of farm and commercial properties and unimproved land usually are higher than those on the sale of a home.

Commissions on the sale of properties may be shared by several employees of a real estate firm. Often, when a sale is made, a commission is paid to the salesman who obtained the listing of the property. The rest of the commission either is retained by the broker who made the sale, or shared by the broker and the agent who handled the transaction. An agent's share of the commission varies greatly from one real estate firm to another; frequently it is about half of the commission.

Many full-time real estate agents earn between $7,000 and $12,000 a year, according to the limited data available. Beginners usually earn less. At the other extreme, many experienced salesmen earn $20,000 or more a year.

Income usually increases as an agent gains experience, but earnings also are affected by factors such as individual ability, economic conditions, and the type and location of property. Salesmen who are active in community organizations and local real estate boards can broaden their contacts and increase their earnings. A beginner's earnings often are irregular. A few weeks or even months may go by without a sale. For this reason, some firms pay salesmen a "draw" against future commissions. However, because this practice is not usual with beginners, most new salesmen should have money to support themselves until their commissions increase.

Brokers provide office space, but salesmen are expected to furnish their own automobiles. Although salesmen and brokers have much independence in planning their schedules, often they work in the evenings and during weekends to meet the convenience of customers. Some salesmen, especially those who work for large firms, are furnished group life, health, and accident insurance.

Sources of Additional Information

Information on licensing requirements for real estate salesmen and brokers is available from the real estate commission or board located in each State capital. This information also can be obtained from most local real estate organizations. Many States can furnish manuals that help applicants prepare for the required written examinations.

Additional information on opportunities in the real estate field, and a list of colleges and universities offering real estate courses may be obtained by writing to:

National Association of Real Estate
Boards, Department of Education,
155 East Superior St., Chicago,
Ill. 60611.

RETAIL TRADE SALESWORKERS

(D.O.T. 260. through 298.877)

Nature of the Work

The success of any retail business depends largely on its salespeople. Courteous and efficient service from behind the counter or on the sales floor does much to satsify customers and to build a store's reputation. Although contact with customers is a part of all sales jobs, the duties, skills, and responsibilities of salespeople are as different as the kinds of merchandise they sell.

In selling items such as furniture,

electrical appliances, or some types of wearing apparel, the salesworker's primary job is to create an interest in the merchandise the store has to offer. The salesman or saleswoman may answer questions about the construction of an article, demonstrate its use, explain how it is cared for, show various models and colors, and otherwise help the customer make a selection. In some stores, special knowledge or skills may be needed to sell the merchandise carried.

In a pet shop, for example, the salesworker should know about the care and feeding of animals. People who sell standardized articles, such as many of the items in hardware and drugstores, are called upon less frequently to give customers this kind of assistance. Often, they do little more than assemble and wrap the items purchased by each customer. (In supermarkets and some drugstores cashiers wrap or bag purchases, receive payments, and make change. See statement on Cashiers.)

In addition to selling, most retail salespeople make out sales or charge slips, receive cash payments, and give change and receipts. They also handle returns and exchanges of merchandise for the customer. Salespersons usually are responsible for keeping their work areas neat and presentable. In small stores, they may assist in ordering merchandise, stocking shelves or racks, marking price tags, taking inventories, preparing attractive merchandise displays, and promoting sales in other ways. (Route salesmen, who sell bread, milk, and other products directly to customers on a regular route, are discussed in the chapter on Driving Occupations.)

Places of Employment

In 1970, about 2.5 million salespersons—three-fifths of them women—were employed in retail businesses. They worked in stores that range in size from the small drug or grocery store, employing only one part-time salesclerk, to the giant department store having hundreds of salesworkers. They also worked for door to door sales companies and mail-order houses. The largest employers of retail salesworkers are department and general merchandise, food, and apparel and accessories stores. Men predominate in stores selling furniture, household appliances, hardware, farm equipment, shoes, and lumber, and in automobile dealerships. (See statement on Automobile Salesmen elsewhere in the *Handbook.*) Women outnumber men in department and general merchandise, variety, apparel and accessories, and in drugstores.

Sales jobs are found in practically every community in all parts of the country. Most salespersons, however, work in large cities and in heavily populated suburban areas.

Training, Other Qualifications, and Advancement

Employers generally prefer to hire high school graduates for sales jobs. Subjects such as salesmanship, commercial arithmetic, and home economics help to give the student a good background for many selling positions. Some high schools have distributive education programs including courses in merchandising and principles of retailing and retail selling. Many programs also provide an opportunity for students to gain practical experience under trained supervision by working part time in local stores. Such part-time selling experience may be helpful in obtaining full-time employment.

Young people interested in obtaining sales jobs may apply to the personnel offices of large retail establishments. Applicants are interviewed and sometimes given special tests that measure their aptitude for sales work. Employers prefer persons who enjoy working with people and have the tact to deal with different personalities. Among other desirable characteristics are a pleasing personality, an interest in sales work, a neat appearance, and the ability to communicate clearly. Prospective salespersons also should be in good general health and able to stand for long periods of time. Arithmetic skills are an asset for salesworkers who calculate prices and make change.

In many small stores, an experienced employee or the proprietor gives newly hired sales personnel on-the-job instructions in making out sales slips and operating the cash register. In large stores, training programs are likely to be more formal, and beginners may be given specialized training to sell certain products.

Executive positions in large retail businesses often are filled by promoting college graduates originally hired as trainees and assigned sales jobs to gain practical experience. However, retail selling is one of the few fields in which an employee who has initiative and ability may be selected for promotion, regardless of his education. Many stores offer opportunities for persons without a college degree to advance to executive positions. Some salespersons eventually become buyers, department managers, or store managers. Others, particularly in large stores, may transfer to office positions that afford opportunities for further promotion to administrative work in areas such as personnel or advertising. Opportunities for advancement are relatively limited in small stores where one person, often the owner, performs most managerial functions. Retail sales experience may be an asset in qualifying for jobs such as selling for wholesalers or manufacturers.

Employment Outlook

The number of salesworkers employed in retail trade is expected to increase slowly through the 1970's. However, openings created by growth and vacancies that must be filled as salespersons retire or stop working for other reasons are expected to number in the tens of thousands each year; additional thousands of jobs will become available as retail salesworkers transfer to other types of employment.

Among the major factors contributing to the anticipated rise in retail sales jobs are population and economic growth, and the resulting increase in the volume of sales. The trend for stores to remain open for longer hours, while the number of weekly hours worked by salespersons continues to decline, also will contribute to the need for more salespersons. In addition to full-time sales jobs, there will be many opportunities for part-time workers, as well as for temporary workers during peak selling periods such as the Christmas season.

Changes in the way goods are sold are likely to limit the number of salesworkers in some types of stores, and affect the kinds of openings that occur in others. Because self-service—already the rule in most food stores—is being extended rapidly to drug, variety, and other kinds of stores, customers will purchase more articles without the help of salesworkers. On the other hand, rising income levels probably will increase the demand for some merchandise that requires the salesperson to spend a good deal of time with each customer. Two examples are electrical appliances and automobiles, which prospective customers may want demonstrated. In view of these developments, sales employment probably will increase more slowly than the volume of sales. Little of the increase is likely to be in routine sales jobs; much of the demand will be for workers who are skilled in salesmanship and well informed about the merchandise they sell.

Some retail salesworkers have more stable employment than workers in many other occupations. When retail sales are affected by downturns in the economy, employers—particularly in large stores—can reduce the number of employees by not filling vacancies that result from turnover or by eliminating some part-time jobs. Competition for sales jobs tends to increase when other jobs are scarce, however, because workers in other occupations often can qualify for sales work.

Earnings and Working Conditions

In 1970, young people starting in routine jobs where they were required to do little more than "wait on" customers generally were paid $1.60 an hour (in many establishments, the minimum wage required by law). In stores where salesmanship is more important, starting salaries sometimes were higher than this; in small establishments not covered by the minimum wage law, they were somewhat lower. Salaries usually are lower in rural than in metropolitan areas.

Experienced salesworkers, including those whose pay scales are determined by union contracts, often earn $3 an hour or more. Many are paid on a straight salary basis; some also receive commissions—that is, a percentage of the sales they make; and still others are on a straight commission basis. Earnings are likely to be highest in jobs that require special skill in dealing with customers, or technical knowledge of the merchandise sold. Among the highest paid are people who sell automobiles, major appliances, and furniture.

Salespersons in many retail stores are allowed to purchase merchandise at a discount, often from 10 to 25 percent below regular prices. This privilege sometimes is extended to the employee's family. Some stores, especially the large ones, pay all or part of the cost of employee benefits such as life insurance, retirement, hospitalization, and surgical and medical insurance.

Some full-time salespersons work a 5-day, 40-hour week, although in many stores, the standard workweek is longer. Some stores are required by law to pay overtime rates for more than 40 hours' work a week. Since Saturday is a busy day in retailing, employees usually work that day and have another weekday off. Longer than normal hours may be scheduled before Christmas and during other peak periods, and employees who work overtime receive additional pay or an equal amount of time off during slack periods. Some salespersons regularly work one evening a week or more, especially those employed by stores in suburban shopping centers.

Part-time salespersons generally work during the store's peak hours of business—daytime rush hours, evenings, and weekends.

Salespeople in retail trade usually work in clean, well-lighted places and many stores are air conditioned. Some sales positions, however, require work outside the store. A salesman of kitchen equipment may visit prospective customers at their homes, for example, to assist them in planning renovations, and a used-car salesman may spend much of his time working at an outdoor lot.

Sources of Additional Information

Information about careers in retail sales is available from:

The National Retail Merchants Association, 100 W. 31st St., New York, N.Y. 10001.

Additional information on careers in retailing may be obtained from the personnel offices of local stores; from State merchants' associations; or from local unions of the Retail Clerks International Association.

Information on retailing courses given in high schools may be obtained from local Superintendents of Schools or from the State Supervisor of Distributive Education in the Department of Education at each State capital.

SECURITIES SALESMEN

(D.O.T. 251.258)

Nature of the Work

When an investor buys or sells stocks, bonds, or shares in mutual funds, he does so through a securities salesman who puts the "market machinery" into operation. A salesman's services are required both by the individual having a few hundred dollars to invest and by the large institution investing millions. Securities salesmen are often called *customers' brokers, registered representatives,* or *account executives.*

In executing a buy or sell transaction, a securities salesman relays the order through his firm's order room to the floor of a securities exchange. In the over-the-counter market, he sends the order to his firm's trading department and notifies the customer when the transaction is completed. He also provides many kinds of related services for his customers. To an inexperienced investor, for example, he may explain the meaning of stock market terms and trading practices. For customers having a variety of holdings, the salesman may offer suggestions about the purchase or sale of a particular security. Customers' investment objectives vary. An individual may prefer long-term investments designed to provide a steady income over the years or short-term investments which appear likely to rise in price quickly. Salesmen, therefore, may be called on to furnish information about the advantages and disadvantages of each type of investment. Salesmen often are expected to furnish the latest stock and bond quotations as well as information regarding the activities and financial positions of corporations.

Salesmen may serve all types of customers or specialize in only one type such as institutional investors. They also may specialize in certain kinds of securities. For example, a salesman may handle only transactions in municipal bonds or only shares in mutual funds. If his employer underwrites "new issues," such as the corporation securities issued for plant expansion funds, he may take part only in the initial sale of these new securities.

Establishing a clientele is very important to the new securities salesman's success. In the beginning, he may spend much of his time contacting potential investors and former customers of his firm, or seeking new customers in other ways. On the other hand, an experienced salesman may spend most of his time servicing the accounts of established customers.

Places of Employment

In 1970, about 200,000 men and women sold securities. Most were full-time employees of securities firms—salesmen, partners, and branch office managers. Others were regularly employed in jobs outside the securities business; most of these persons sold shares in mutual funds or variable annuities (contracts yielding periodic payments that fluctuate with the value of securities or other variable factors). Over one-third of all securities salesmen work part time; the majority are men.

Securities salesmen are employed by hundreds of brokerage firms, investment bankers, and mutual fund firms in all parts of the country. Many of these firms are very small. Most salesmen, however, work for a relatively small number of large firms that operate main offices located in big cities (especially in New York City), and approximately 7,000 branch offices in other areas.

Training, Other Qualifications, and Advancement

Because a securities salesman must be well informed about economic conditions and trends, a college education is becoming increasingly important for applicants in this field. Although employers seldom require specialized training, a degree in business administration, economics, or liberal arts is regarded as good preparation. Courses in finance and other subjects related to the securities business, available at colleges and universities throughout the country, also are helpful.

Almost all States require securities salesmen to be licensed. State licensing requirements vary. The applicant may have to furnish a personal bond or pass written examinations.

In addition, practically every salesman must be registered as a representative of his firm according to regulations of the securities exchange or exchanges where it transacts business, or the National Association of Securities Dealers, Inc. (NASD), or both. Before beginning salesmen can qualify as registered representatives, they must pass the Securities and Exchange Commission's General Securities Examination, or examinations prepared by the exchanges and/or the NASD. These test the prospective salesman's knowledge of the securities business. Character investigations also are required.

Most employers provide training to assist their salesmen in meeting the requirements for registration. In many firms, including all members of the New York Stock Exchange, the training period equals at least 6 months. In large firms, training programs are sometimes quite elaborate. Trainees may receive classroom instruction in subjects such as security analysis and effective speaking, take courses offered by schools of business and other institutions and associations, and undergo a period of on-the-job training. Other training programs, particularly in small firms, may be relatively informal and brief. In programs of the latter type, the trainee may read assigned materials and observe other salesmen as they transact business.

Many employers consider personality traits as important as academic training in specialized fields. Employers seek applicants who are well groomed, who possess the ability to deal with people, and who are ambitious and have a sense of responsibility. Because maturity and the ability to work independently also are important, many employers prefer prospective salesmen to have previous experience in other jobs. Before being hired, applicants are sometimes given tests to determine their aptitude for this kind of sales work.

The principal form of advancement for securities salesmen is an increase in the number and the size of the accounts they handle. Although a beginner usually starts by servicing the accounts of individual investors, eventually he may handle very large accounts such as those of institutional investors. Some experienced salesmen may advance to positions as branch office managers, who supervise the work of other salesmen while executing buy and sell orders for their own customers. A few salesmen may become partners in their firms or perform other administrative work.

Employment Outlook

Employment of securities salesmen is expected to increase moderately during the 1970's. Some new positions will be created to serve the growing number of individuals and institutions investing money in securities of all kinds. Most positions, however, will be vacancies that occur as salesmen retire or leave the occupation for other reasons. The number of beginners who leave the occupation tends to be high because of the difficulty new salesmen have in establishing a clientele.

Several factors should contribute to expanding employment opportunities for securities salesmen over the next decade. Both the number of individual investors and the funds they have to invest will continue to increase as a result of economic growth, rising personal incomes, and a number of other factors. The latter include interest stimulated by the activities of investment clubs and associations, plans enabling small investors to make minimum monthly payments toward the purchase of securities, and the increasing need for parents to set aside funds for their children's education and their own retirement. Institutional investors also can be expected to have more funds for investment in the future as more people purchase insurance; participate in pension plans; contribute to the endowment funds of colleges, universities and other nonprofit institutions; and deposit their savings in banks. Many more securities salesmen will be needed also to sell new securities issued by expanding corporations and by State and local governments financing construction of new roads and other public improvements.

Earnings and Working Conditions

Trainees are usually paid a salary until such time as they are able to meet licensing and registration requirements. After registration, a few firms continue to pay a salary until the new salesman's commissions increase to a minimum amount. The salaries paid during the training period usually range from $400 to $500 a month; brokers employed in large firms receive somewhat higher salaries. Factors which help determine salary during the training period include locality of the firm, the individual's educational background, and his experience.

Once the salesman has completed his training, earnings are usually in the form of commissions from customers' sale and purchase of securities. Size of the commission depends partly on the policies of the firm, partly on the type of security bought or sold, and also on whether it was traded on a stock exchange or in the over-the-counter market. Commission earnings may fluctuate because of extremes in market activity. Earnings are likely to be high when there is much buying and selling and lower when there is a severe slump in market activity. To provide their salesmen with a steady income, most firms pay a "draw against commission"—that is, a minimum salary based on the commissions which salesmen can be expected to earn—plus commissions from additional sales. A few firms pay salesmen only salary and bonuses, usually determined by company business.

Earnings of securities salesmen working full time generally ranged between $8,000 and $17,000 a year in 1970, according to the limited data available. Many successful

salesmen have incomes over $25,000 a year, however. Salesmen paid on a commission basis may receive annual bonuses when business is good.

A securities salesman works in an office which is the scene of much activity. In large offices, rows of salesmen generally sit at desks in front of "quote boards" and wall screens, which continually flash information on securities transactions and prices. Most offices provide seats so that customers and other persons may watch the latest market developments.

Although securities salesmen usually are not required to observe fixed hours of work, many work approximately the same hours as others in the business community. Some also must adjust their time to accommodate those customers who can meet with them only outside business hours—for example, at home in the evenings or on weekends.

Sources of Additional Information

Further information about the work of securities salesmen in firms that are members of the New York Stock Exchange and about the nature of the securities business is available from:

New York Stock Exchange, 11 Wall St., New York, N.Y. 10005.

Information about the investment banking business and sales positions with investment bankers may be obtained from:

Investment Bankers Association of America, 425 13th St. NW., Washington, D.C. 20004.

WHOLESALE TRADE SALESWORKERS

(D.O.T. 260. through 289.458)

Nature of the Work

Salesworkers in wholesale trade play an important part in moving goods from the factory to the consumer. Each salesman may represent a company that distributes hundreds of similar products. A wholesale drug company, for example, may stock its warehouse with many brands of drugs, soap, and cosmetics to supply drug, variety, and other stores that sell directly to the consumer. In much the same way, a wholesale building materials distributor sells hardware and construction materials to builders who would otherwise have to deal with many manufacturers.

At regular intervals, the salesman visits buyers for retail, industrial, and commercial firms, as well as those for institutions such as schools and hospitals. He shows them samples, pictures, or catalogs listing the items his company stocks. The salesman seldom urges customers to purchase any particular product, since he handles a very large number of items; his objective is to persuade buyers to become regular customers. His success depends upon prompt and dependable service to keep customers well supplied.

Wholesale salesmen render a variety of special services that are becoming increasingly important. Retailers sometimes depend on them to check the store's stock and order items that will be needed before the next visit. Some wholesale salesmen assist store personnel in applying electronic data processing systems to their ordering and inventory tasks.

In addition, they often advise retailers about advertising, pricing, and arranging window and counter displays. A salesman of specialized products, such as air-conditioning equipment, may give technical assistance on installation and maintenance.

Salesmen are responsible for some paperwork and other details. They must forward orders to the wholesale house, prepare reports and expense accounts, plan their work schedule, compile lists of prospects, make appointments, and study literature relating to their products. Some salesmen collect money for their companies.

Places of Employment

About 540,000 salespeople, mostly men, worked for wholesalers in 1970. Wholesale houses are located mainly in cities, but the territories assigned to salesmen may be in any part of the country. This territory may cover a small section of a city having many retail stores and industrial users; however, in less populated regions it may cover half a State or more.

Companies that sell foods and food products are leading employers of wholesale salesmen. Other large employers are wholesalers dealing in drugs, dry goods and apparel, motor vehicle equipment, and electrical appliances. Many salesmen also work for establishments selling machinery and building materials to industrial and business firms.

Training, Other Qualifications, and Advancement

In hiring trainees for sales work, most wholesalers seek young persons who are outgoing and neat in appearance. Other traits include self-confidence, enthusiasm for the job, and an understanding of human nature. As in most selling jobs, skills in arithmetic and a good memory are assets. High school graduation is the usual educational requirement, although many companies selling technical and scientific products prefer men who have specialized training beyond high school. In some cases, an engineering degree is required.

Prospective salesmen who are college graduates usually participate in formal training programs that combine classroom instruction and short rotations in various nonselling jobs. By working a few weeks in the wholesaler's warehouse, for example, a new salesman may gain first-hand experience in writing orders, pricing, and locating stock. Through cooperative programs, some college students combine academic study and on-the-job experience. Graduates having this background often begin outside saleswork without further training.

The high school graduate may begin his career with a wholesale firm in a nonselling job, or he may be hired as a sales trainee. In either case, the beginner usually works in several kinds of nonselling jobs before being assigned as a salesman. He may begin in the stockroom or shipping department to become familiar with the thousands of items the wholesaler carries. Later he may learn the prices of articles and discount rates for goods sold in quantities. Next, he is likely to become an "inside salesman," writing telephone orders. In this job and later as he accompanies an experienced salesman on calls, the trainee comes to know some of the firm's customers. The time spent in these initial jobs varies among companies; usually it takes 2 years or longer to prepare the trainee for outside selling. After he has become familiar with the company's products and techniques of selling, he is assigned a territory.

Experienced salesmen who have leadership qualities and sales ability may advance to supervisor, sales manager, or another executive position.

Employment Outlook

Employment opportunities for salesworkers in wholesale trade are expected to be good through the 1970's. In addition to new positions created as a result of growth, thousands of openings will occur each year as salesmen retire, die, or transfer to other kinds of work; turnover among newly-hired salesworkers is high.

The number of wholesale salesworkers is expected to rise rapidly as business increases due to population expansion and economic growth. Although the computer will relieve wholesale salesmen of some duties, an increasing proportion of their time will be spent rendering special services to customers.

As chain stores and other large firms centralize their purchasing activities, the value of the sales made to individual customers becomes larger and competition for sales correspondingly greater. Wholesalers can be expected to meet this competition by emphasizing sales activities.

Earnings and Working Conditions

According to limited information, most beginning salesmen earned around $9,000 a year in 1970. Experienced salesmen averaged $15,000 annually, and many earned considerably more.

Most employers pay a salary plus a percentage commission on sales; others pay a straight commission. Practically all wholesale salesmen have steady, year-round work. However, their sales (and their commissions) vary from month to month because demand for some products—for example, air conditioners—is greater during certain seasons. To provide salesmen with a steady income regardless of sales, many companies pay experienced salesmen a "draw" against the commissions they can expect to earn annually. Most companies furnish each salesman a car or allowance if he uses his own car, and reimbursement for certain expenses on the road.

The salesman often works long, irregular hours. Although he calls on customers during business hours, he may travel at night or on weekends to meet his schedule. However, most salesmen seldom are away from home for more than a few days at a time. They may spend many evenings writing reports and orders. Salesmen generally carry heavy catalogs and sample cases and are on their feet long periods of time.

Depending on length of service with their employers, most salesmen have a 2-to-4-week paid vacation. Many are covered by company benefits, including health and life insurance and retirement pensions.

Sources of Additional Information

Information on jobs in wholesale selling may be obtained directly from local wholesale houses or from associations of wholesalers in many of the larger cities. If no local association is available, write to:

National Association of Wholesaler-Distributors, 1725 K St. NW., Washington, D.C. 20006.

Sales and Marketing Executives International, Student Education Division, 630 Third Ave., New York, N.Y. 10017.

SERVICE OCCUPATIONS

Workers in service occupations police streets, serve food, put out fires, clean homes and buildings, and, in numerous other ways, provide services to the American people. The more than 9.7 million service workers who were employed in 1970 included a wide range of occupations such as babysitters, policemen, cooks, hospital attendants, golf caddies, theatre ushers, barbers, and cleaning women. The major groups of service workers are discussed below:

Occupations related to food preparation and service. In 1970, more than 2.7 million people, or approximately three-tenths of all service workers, were employed in this group which includes occupations such as cooks and chefs, kitchen workers, waiters and waitresses, counter and fountain workers, and bartenders. These workers are employed in hotels, restaurants, and other institutions, such as hospitals, schools, and plant cafeterias.

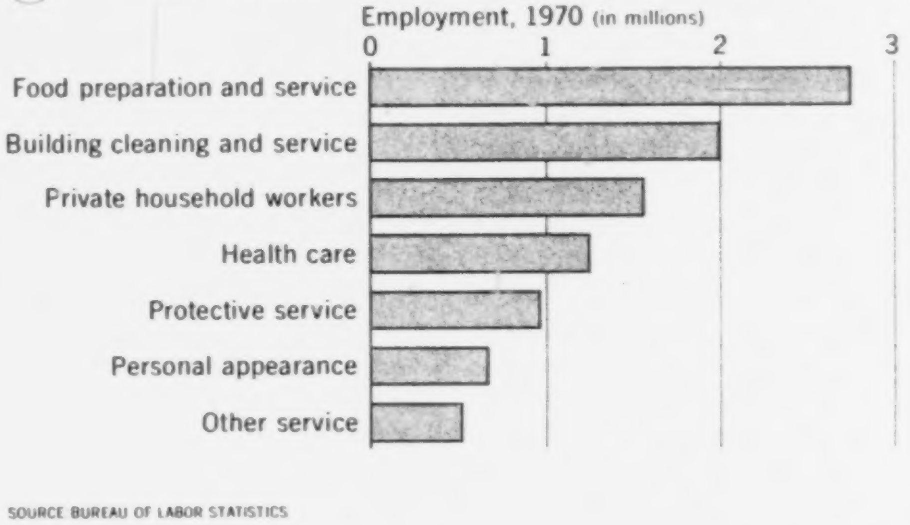
Building cleaning and servicing occupations. The nearly 2 million persons employed to clean and provide other services in buildings made up the second largest group of service workers in 1970. This group includes workers in occupations such as janitors, charwomen, chambermaids, and elevator operators.

Private household workers. About 1.5 million people were employed as private household workers in 1970. Altogether they made up the third largest group of service workers and constituted almost one-fifth of all service worker employment. Private household workers perform tasks that are familiar to all homemakers. They prepare and serve meals, make beds, do cleaning and laundering, take care of children, and perform other household duties as well. (This chapter includes a detailed statement covering private household workers.)

Protective service workers, another large group of service workers, are needed to help safeguard lives and property. More than 950,000 workers, or one-tenth of all service workers, were employed in protective service occupations in 1970. The majority of these workers are policemen, guards, or firemen. Policemen and detectives together account for more than one-third of the total number of protective service workers. Most policemen and detectives are government employees, but some work for hotels, stores, and other businesses. Guards and watchmen, another large group of protective service workers, are employed chiefly by private companies to protect their property and enforce company rules and regulations. Some guards and watchmen are employed in jails, prisons, and other government establishments. Firemen, also a significant group of protective service workers, are employed mainly by city governments. The remaining protective service workers are sheriffs and bailiffs, crossing watchmen and bridge tenders, and marshals and constables. This chapter includes separate statements for FBI special agents, police officers (local government), State police officers, firefighters, and guards and watchmen.

The remaining service workers —those concerned with providing health care, grooming and personal services, and people in occupations related to entertainment and leisure time activities—accounted for about 2.5 million workers. More than 1 million were employed in health service occupations, which include workers such as hospital attendants and nurse aides. Service occupations concerned with grooming and personal services, such as barbers and cosmetologists, provided employment for over 800,000 workers. Nearly 100,000 workers were em-

㉑ **Nearly 10 million persons work in service occupations**



SOURCE BUREAU OF LABOR STATISTICS

ployed in occupations related to entertainment. This group includes occupations such as ski instructors, ushers, and check room attendants. All other service workers, nearly 300,000, were in occupations such as airline stewardess and travel guide.

Some of the occupations mentioned briefly in this introduction are described in greater detail later in this chapter. They are cook and chef, waiter and waitress, bartender, hospital attendant, barber, and cosmetologist. Other personal service occupations, including the airline stewardess, hotel bellman, human services aide, and hotel housekeeper and assistant, are discussed elsewhere in the *Handbook*.

Training, Other Qualifications, and Advancement

Training and skill requirements differ greatly among the various service occupations. FBI special agents, for example, must have a college degree. Barbers and beauty operators need specialized vocational training. Still other occupations—general maid, waitress, and hotel bellman, for example—have no specific educational requirements for entry, although a high school diploma is always an advantage. The Federal Government sponsors training for many service occupations under provisions of the Manpower Development and Training Act.

For many service occupations, personality traits and special abilities may be as important as formal schooling. Thus, physical strength and endurance are a necessity for work as a porter, life guard, or window cleaner; and a pleasing manner and appearance are especially important for the theater usher, elevator operator, and checkroom girl. Still other service workers, including store and hotel detectives and travel guides, should possess good judgment and be skillful in dealing with people.

Some service workers eventually go into business for themselves—as caterers or restaurant operators, for example, or proprietors of barber or beauty shops. Advancement from service occupations that require little specialized training or skill may be difficult, however, particularly for young people without a good basic education and some knowledge of the business in which they are employed.

Employment Trends and Outlook

For many years, the number of workers in service occupations has been growing at about the same rate as the labor force as a whole. Between 1960 and 1970, both increased by about 20 percent. Among service workers, health service employment increased by nearly two-thirds since the early 1960's. Employment in food services has risen by about one-fourth; and entertainment services, food services, protective services, and personal appearance services by about 20 percent. Employment of private household workers, however, decreased by 20 percent, despite a strong demand for their services.

Employment in service occupations is expected to increase faster than the labor force as a whole in the years ahead as income levels rise and leisure time increases. By 1980, as many as 4 million more workers may be providing the services that add to people's comfort and enjoyment and protect life and property. As total employment rises, however, different occupations within the service group are likely to be affected quite differently—some growing very rapidly, others only moderately, and a few decreasing in size.

Most of the future employment increase is expected to be among policemen and other protective service workers; attendants in hospitals and businesses rendering professional and personal services; beauty operators; and cooks, waiters, and others who prepare and serve meals outside private homes. Some of the factors responsible for their growth are the added medical care related to the increase in population, especially the number of older people; the greater need to protect life and property as urbanization continues and cities become more crowded; and the more frequent use of restaurants, beauty parlors, and other services by families and individuals as income levels rise and as an increasing number of housewives take jobs outside the home.

Although service workers are employed throughout the country, firefighters, hospital attendants, hotel service employees, and amusement and recreation attendants are found chiefly in the larger towns and cities.

BARBERS

(D.O.T. 330.371)

Nature of the Work

Barbers provide many services related to the care of hair, face, and scalp. They may give hair and scalp treatments, shaves, facial massages, and shampoos. Their main task,

however, is to cut hair to satisfy each customer.

In recent years, an increasing proportion of men have desired additional barbering services, such as hairstyling and coloring. Specially trained barbers, called "hairstylists," are providing these services in some barbershops and styling salons. These barbers shampoo, cut the hair with a razor, and style it. They also may color the hair and fit hair pieces.

A barber builds a steady clientele by giving good haircuts, putting customers at ease, giving them efficient, courteous service, and keeping a clean, attractive shop.

Barbers keep their barbering instruments sterilized and in good condition. They also clean their work areas and may sweep the shop. Those who own or manage a shop have additional responsibilities such as ordering supplies, paying bills, keeping records, and hiring employees.

Places of Employment

An estimated 180,000 barbers were employed in 1970; most of them were men. More than half of all barbers own and operate their own shops. Most barbers work in small shops, either as the owner or with one other barber. Many barbers also work in large shops in shopping centers, hotels, or office buildings. Some barbers work in combination barber-and-beauty shops; a few work for government agencies and hospitals.

All cities and towns and many very small communities have barbershops. However, employment is concentrated in large cities and in the most populous States.

Training, Other Qualifications, and Advancement

To obtain a license, which all States require, a candidate must have graduated from a State approved barber school.

In addition, he must meet certain health requirements, usually be at least 16 (in some States 18) years old, and have completed the eighth grade. All but a very few States require the beginner to take an examination for an apprentice license; then, usually after working 1 or 2 years as an apprentice, he takes a second examination for his license as a registered barber. The examinations usually include both a written test and a demonstration of the applicant's ability to cut hair. The fees charged for these examinations generally range from $5 to $25. A few States do not require a fee for their apprentice examination. Barbers who move to another State must meet the licensing requirements of that State.

Barber training is offered in many public and private schools and a few vocational schools. Courses usually last 6 to 11 months and include from 1,000 to 2,000 hours of instruction. The trainee customarily purchases his own tools which cost $100 or more. He studies the basic services—haircutting, shaving, massaging, and facial and scalp treatments—and, under supervision, practices these services on fellow students and customers in school "clinics." Besides attending lectures on barber services and the use and care of instruments, the student takes courses in anatomy, sanitation, and hygiene, and learns how to recognize certain skin conditions. Instruction is also given in salesmanship and general business practices. Advanced courses are available in some localities for registered barbers who wish to specialize in hair styling and coloring.

A beginner may locate his first job through the barber school he attended, or through the local barber's union or employer's association.

Some experienced barbers advance by becoming managers of large shops or by opening their own shops. A few, who meet the requirements, may teach at barber schools. Barbers who go into business for themselves must have the capital to buy or rent a shop and install equipment. The required capital differs, because some owners buy used equipment and fixtures at reduced prices, whereas others pay higher prices for new equipment. Equipping a one-chair shop with new equipment usually costs from $1,500 to $2,800.

Dealing with customers requires patience and a better-than-average disposition. Good health and stamina also are important because a barber must stand for long periods and work with both hands at shoulder level.

Employment Outlook

Employment of barbers is expected to grow slowly through the 1970's. Most job openings will result from the need to replace experienced barbers who retire, die, or transfer to other fields of work. Replacement needs in this occupation are relatively high because barbers are somewhat older, on the average, than workers in other occupations.

Employment opportunities for barbers have been limited in recent years by the trend to longer hair. In the future, however, the effect of this trend is expected to be more than offset by population increases. Employment also may be stimulated by the growing popularity of hair styling for men.

The small shop with only one or two barbers will probably remain the most common type of establishment; however, the continued growth of suburban communities should result in opportunities to open large shops and expand staffs in established shops in these areas.

Earnings and Working Conditions

Barbers receive income from commissions or wages and from tips. Most barbers who are not shop owners normally receive 65 to 75 percent of the money they take in; a few are paid straight salaries.

Weekly earnings of experienced barbers (including tips), generally ranged between $150 and $175 in 1970 according to limited information available. A few expert barbers, as well as some barbers who operated their own shops, earned more than $250 a week. Apprentice barbers usually earned about $85 to $125 a week.

Earnings depend on the size and location of the shop, customers' income levels and tipping habits, competition from other barbershops, the barber's skill at his trade, his ability to attract and hold regular customers, and the prices he charges for his services.

Most full-time barbers work more than 40 hours a week; a workweek of over 50 hours is not uncommon. A barber may have a steady stream of customers during peak hours and especially on Saturdays, but during slack periods he may have time off for personal matters. Some barbers, however, are now requiring appointments to regulate their working hours. Under some union contracts, barbers receive 1- or 2-week paid vacations, insurance, and medical benefits.

The principal union which organizes barbers—both employees and shopowners—is the Journeymen Barbers, Hairdressers, Cosmetologists and Proprietors' International Union of America. The principal trade association which represents and organizes shopowners and managers is the Associated Master Barbers and Beauticians of America.

Sources of Additional Information

Information on State licensing requirements and approved barber schools may be obtained from the State Board of barber examiners or other State authority at each State capital.

General information on training facilities, and State licensing laws may also be obtained from:

National Association of Barber Schools, Inc., 750 Third Ave., Huntington, W. Va. 25701.

Additional information on this occupation is also available from:

Associated Master Barbers and Beauticians of America, 219 Greenwich Rd., P.O. Box 17782, Charlotte, N.C. 28211.

Journeymen Barbers, Hairdressers, Cosmetologists, and Proprietors' International Union of America, 1141 North Delaware St., Indianapolis, Ind. 46207.

COSMETOLOGISTS

(D.O.T. 332.271 and .381;
331.878; and 339.371)

Nature of the Work

Cosmetologists shampoo, cut, set, style, straighten, bleach, and tint hair and give permanent waves. They also may give manicures and scalp and facial treatments, provide makeup analysis, shape eyebrows, and clean and style wigs and hair pieces. Other duties include making appointments with patrons, cleaning their equipment, and sanitizing implements. Cosmetologists are also called *beauty operators, hairdressers,* or *beauticians.*

Beauty operators may specialize in different phases of the work such as manicurist, tint specialist, or hair stylist. Many men employed as cosmetologists are hair stylists.

The owner-operator of a beauty salon, in addition to working as an operator, usually performs a number of managerial duties, such as recordkeeping, property maintenance, control of supplies, and supervision of employees.

Places of Employment

Approximately 485,000 people were employed as hairdressers and cosmetologists in 1970; about 10 percent were men. The proportion of part-time to full-time workers was relatively high.

Most cosmetologists are employed in salons which are operated as independent establishments or in conjunction with hotels and department and specialty stores. Smaller numbers work in a variety of other establishments—for example, in motion picture and television studios, in hospitals, and on ocean liners.

Although employment is concentrated in urban areas, many operators work in small towns and rural areas in all parts of the country. Most beauty salons are small and have fewer than four employees. More than half of all beauty salons are owner-operated.

Training, Other Qualifications, and Advancement

All States require that beauty operators be licensed. Before applicants are eligible to take State licensing examinations in the theory and practice of cosmetology, they usually must be at least 16 years of age, present certificates of good health, and have completed at least the 10th grade—many states require a high school diploma. Successful completion of a State-approved cosmetology course is recognized as adequate preparation for these examinations in all States; in some, a period of apprenticeship may be substituted. Most States provide for reciprocity, whereby operators licensed to work in one State can move to another and continue their work without taking an examination to qualify for another license.

About 3,500 public vocational schools and private schools offer training which meets State licensing requirements for cosmetologists. In many of them, instruction preparing students for a general operator's license is available in evening classes as well as in full-time day classes. Many daytime courses offered by public and private schools require from 6 months to a year to complete. Other public school courses, which include academic subjects required for a high school diploma, last from 2 to 3 years. Apprentice training usually continues over 1 or 2 years. Many States issue special manicurists' licenses which require substantially fewer hours of training than general operator's licenses.

Both public and private school training programs include classroom study, lectures, demonstrations, and practical work. Beginning students usually practice by working on each other or on manikins and, when they have satisfactorily completed a period of preliminary training, they may practice on patrons in school "clinics." Practically all beauty schools help their students find jobs after graduation.

Some cosmetologists start as manicurists or shampooers, while others begin as all-round operators performing a variety of services. Advancement may come in higher earnings, as operators gain experience and build up a steady clientele, or as they become skilled specialists in one or more phases of the work. For those who wish to specialize, advanced courses in hair styling, hair coloring, and other types of work are available in many localities, sometimes offered by public or private schools, and sometimes by manufacturers of beauty preparations or by other individuals and organizations. Experienced operators may also advance to positions in which they manage large salons or open salons of their own. Others advance to teaching positions in cosmetology schools, or use their knowledge and skills in some different type of employment—working as demonstrators for manufacturers of cosmetics, for example, or as beauty editors for newspapers and magazines, or inspectors for State cosmetology boards.

Cosmetologists must keep abreast of changing hair styles and beauty techniques. Ability to get along with people is also important, as are good grooming, dexterity, a sense of form and artistry, and willingness to follow patrons' instructions. An operator's job also calls for physical stamina, because much standing is normally required.

Operators usually furnish their own uniforms; a few salons require them to furnish brushes, combs, and clips.

Employment Outlook

Through the 1970's, job opportunities are expected to be very good for newcomers to this field, as well as for experienced cosmetologists and those who are seeking part-time work. Employment in this occupation is expected to continue to expand very rapidly. Among the factors responsible for this expected employment growth are the population increase and the more frequent use of beauty salons as income levels rise and more women take jobs outside the home.

In addition to new job opportunities created by growth, thousands of replacements will be needed as cosmetologists retire or stop working for other reasons. Still other openings will become available as jobs are vacated by workers leaving to enter other kinds of employment.

Earnings and Working Conditions

Many cosmetologists are paid on a straight commission basis. Others receive a salary plus commission and still others, a straight salary. Estimating total earnings is difficult because, in addition to salaries and commissions, most cosmetologists receive tips, and tipping practices vary in different localities. Earnings of cosmetologists also depend on experience, speed of performance, skill, location of the salon, and the ability to satisfy patrons and build up a clientele.

Many beginning operators earn between $65 and $90 a week, according to limited information available. A very few top stylists and others in highly specialized jobs may earn $300 or more a week.

Most full-time operators work 40 hours or longer a week, which usually includes late afternoon and Saturday work. Many part-time operators are also employed during these busy periods.

In many large salons, department stores, and hotels, operators may participate in group life and health insurance and other employee benefit plans sponsored by the employer. Some establishments allow their employees annual paid vacations of at least 1 week after a year's service.

The most active union in this occupational field is the Journeymen Barbers, Hairdressers, Cosmetologists and Proprietors' International Union of America. Other organizations in the field are the National Hairdressers and Cosmetologists Association, Inc., which includes both shopowners and operators; The Associated Master Barbers and Beauticians of America, representing salon owners and managers; the National Association of Cosmetology Schools, Inc. representing school owners and teachers; and the National Beauty Culturists' League, made up of Negro operators, teachers, managers, and salon owners.

Sources of Additional Information

State boards of cosmetology can supply information about approved training schools and requirements for licensing.

Additional information about careers in beauty culture, and State licensing requirements, can be obtained from:

National Beauty Career Center,
3839 White Plains Rd., Bronx, N.Y. 10467.

General information about cosmetology may be obtained from:

National Hairdressers and Cosmetologists Association, 3510 Olive Street, St. Louis, Missouri 63103.

Journeymen Barbers International Union, 1141 North Delaware St., Indianapolis, Ind. 46207.

COOKS AND CHEFS

(D.O.T. 313.131 through .887; 314.381 through .878; and 315.131 through .381)

Nature of the Work

The nature of a cook's job depends partly on where he works. There is a good deal of difference, for example, in preparing food for students in a high school cafeteria, for passengers on a jet airliner, or for patients in a hospital. Similarly, the "home cooking" which is the trademark of many small establishments is far different from the elaborate cuisine featured in some cosmopolitan restaurants; and the cook who works in a steak house prepares food that is quite different from that prepared by the cook in a restaurant which serves Chinese dishes.

A cook's duties also depend on the size of the establishment in which he works. In many small restaurants, one cook—perhaps aided by a short order cook and one or two kitchen helpers—prepares all the foods. Often, the menu consists of a few dishes prepared on a short order basis, plus pies and other baked goods purchased at a bakery.

Large eating places are more likely to have varied menus and to prepare on the premises all the food served. The kitchen staff often includes several cooks—sometimes called assistant cooks—and many kitchen helpers. Each cook usually has a special assignment and often a special job title—pastry cook, fry cook, roast cook, vegetable cook, or sauce cook, for example. The head cook or chef—or, in a large restaurant or hotel, the executive chef—coordinates the work of the kitchen staff and often may take direct charge of certain kinds of food preparation. He decides on the size of the food portions served, and sometimes plans menus and purchases food supplies. In addition, he has the important responsibility of seeing that the dishes served taste good and are attractive. Because of their special skill in creating new dishes and improving the flavor of familiar ones, some chefs have acquired national and international reputations for themselves and for the restaurants and hotels where they work.

Places of Employment

Approximately 740,000 cooks and chefs were employed in 1970. Most of these workers were restaurant cooks, but large numbers were employed in public and private schools and in hotels and hospitals. Government agencies, manufacturing plants, private clubs, and many other kinds of establishments also employed cooks and chefs.

Three out of every 5 of these workers are women. About half of the cooks in restaurants, and the great majority of those employed in schools and hospitals, are women. Men, on the other hand, outnumber women as cooks in hotels and private clubs. Also, most head cooks and practically all chefs are men.

Training, Other Qualifications, and Advancement

Most cooks—particularly those who work in small eating places—acquire their skills on the job while employed as kitchen helpers. Less frequently, they are trained as apprentices under trade union contracts or the training programs which some large hotels and restaurants conduct for new employees.

Young people seeking jobs in large restaurants and hotels will find it advantageous to have had courses in restaurant cooking because hiring standards are often high in these establishments. Many vocational schools—both public and private—offer this kind of training to high school students. Other courses, open in some cases only to high school graduates, are given under the guidance of restaurant associations, hotel management groups, and trade unions, and in technical schools and colleges. These courses range from a few months to 2 years or more in length. Programs to train unemployed and underemployed workers for jobs as cooks were operating in several cities in 1970 under the Manpower Development and Training Act.

Although curriculums may vary, a student usually spends a major part of his time learning food preparation through actual practice in well-equipped kitchens. The student receives instruction in baking, broiling, and other methods of preparing food, and in the use and care of kitchen equipment. Instruction may be given in selecting and storing food, determining the size of portions, planning menus, and buying food supplies in quantity. Hotel and restaurant sanitation, and public health aspects of food handling, are also taught.

Many school districts provide

on-the-job training opportunities for their cafeteria workers who wish to become cooks. In addition, they may conduct cooking workshops during the summer, and frequently select school cooks from employees who have participated.

Inexperienced workers usually can qualify as assistant cooks or fry cooks after several months of on-the-job training, but acquiring all-round skills necessary for advancing to head cook or chef in a fine restaurant often takes several years. Many cooks acquire higher paying positions and new cooking skills by moving from restaurant to restaurant. Some eventually go into business as caterers or restaurant owners; other may become instructors at vocational schools and other institutions.

Cleanliness, the ability to work under pressure during busy periods, physical stamina, and a keen sense of taste and smell are among the important qualifications needed for this occupation. A cook or chef in a supervisory position must not only be an expert cook, but must also be able to organize and direct kitchen operations effectively. Health certificates, indicating that cooks and chefs are free from communicable diseases, are required by the laws of many States.

Employment Outlook

Employment of cooks and chefs is expected to increase moderately through the 1970's as new restaurants, hotels, and other food establishments open. Besides job openings resulting from employment growth, thousands will result each year from the need to replace experienced cooks and chefs who retire, die, or transfer to other occupations.

Continued expansion in the business of serving meals away from home is expected because of population growth and relatively rapid increases likely among some groups who customarily eat away from home. Large increases are expected in the number of married women working outside their homes and the number of students attending schools and colleges. In hospitals and other institutions, a continued increase is foreseen in the number of patients, attendants, and others who regularly eat on the premises. In addition, travel for business and pleasure is expected to increase; as a result, more people will be patronizing eating places.

Small restaurants and other eating places where the food preparation is fairly simple will provide the greatest number of starting jobs as cooks. Beginners—especially those having training in restaurant cooking—also will find starting positions available in those hotel and restaurant kitchens where foods are prepared more elaborately. The shortage of highly skilled cooks and chefs is acute, and employment opportunities for well qualified beginners will be especially good.

Earnings and Working Conditions

Limited wage data from union-management contracts covering eating and drinking places in large metropolitan areas provide an indication of earnings for cooks and chefs in 1970. In these contracts, straight-time hourly pay rates generally ranged from $2.22 to $4.65 for chefs; $2.02 to $4.12 for cooks of various types (such as pastry, fry, roast, and vegetable cooks); and $1.47 to $3.86 for assistant cooks. However, most cooks and chefs are not covered by union-management contracts. Wages also vary greatly according to geographic location and type of establishment. In large restaurants and hotels many cooks and chefs earn considerably more than the minimum rates. Some chefs with national reputations make more than $25,000 a year.

In addition to their wages, restaurant cooks usually receive at least one free meal a day and are furnished with uniforms. Paid vacations and holidays are common, and various types of health insurance programs also are provided. Scheduled hours in restaurants include late evening, holiday, and weekend work, and range from 40 to 48 a week. Cooks employed in public and private schools work during the school year only—usually 9 months. The hours worked frequently coincide with the school's hours.

Many kitchens are air conditioned, have convenient work areas, and are furnished with modern equipment and laborsaving devices. Others—particularly kitchens in small eating places—are often not as well-equipped and working conditions may be less desirable. In kitchens of all kinds, however, cooks spend long periods on their feet and may be required to lift heavy pots and other objects or work near hot ovens or ranges.

The principal union organizing cooks and chefs is the Hotel & Restaurant Employees and Bartenders International Union.

Sources of Additional Information

Information about job opportunities may be obtained from local employers, locals of the Hotel & Restaurant Employees and Bartenders International Union, and local offices of the State employment service. The State employment service also may be a source of information about the Manpower Development and Training Act and other training programs.

General information about restaurant cooks and chefs is available from the:

Culinary Institute of America, Inc.
393 Prospect Street, NW., New Haven, Conn. 06511

Educational Director, National Restaurant Association, 153 North Lake Shore Dr., Chicago, Ill. 60610.

The Educational Institute, American Hotel and Motel Association, 221 West 57th Street, New York, N.Y. 10019.

A list of public and private schools offering courses in cooking may be obtained from:

Council on Hotel, Restaurant, and Institutional Education, 1522 K St., N.W., Washington, D.C. 20005.

WAITERS AND WAITRESSES

(D.O.T. 311.138 through .878)

Nature of the Work

Whether they work in small lunchrooms or fashionable restaurants, all waiters and waitresses have jobs that are essentially the same. They take customers' orders, serve food and beverages, make out customers' checks, and sometimes take payments. The manner in which waiters and waitresses go about their work may vary considerably, however, because food service in very small eating places differs from that in large ones; and service in restaurants that emphasize speed and efficiency is different from that where dining is formal and leisurely.

In addition to waiting on tables, waiters and waitresses usually perform a variety of other duties. Often, they set up and clear tables, and carry dishes back to the kitchen. In very small restaurants, they may combine waiting on tables with counter service, preparing sandwiches, or cashiering.

However, in large restaurants and in places where meal service is formal, waiters and waitresses are relieved of most of those additional duties. Busboys and busgirls often set up tables, keep water glasses filled, and perform other routine tasks, leaving the waiters and waitresses free to devote practically all of their time to serving guests.

In those eating places where meals are served elaborately and a great deal of emphasis is placed on the satisfaction and comfort of each guest, a waiter may be called upon to advise about the choice of a wine or answer questions about the preparation of items on the menu. Sometimes, from a side table, he may prepare and serve salads or flame certain dishes such as crepes suzettes.

Places of Employment

More than a million waiters and waitresses were employed in 1970. The great majority—about 9 out of every 10—were women. Many waiters and waitresses worked part time.

Approximately four-fifths of the waiters and waitesses were employed in restaurants and other retail establishments that serve food. Hotels and educational institutions of all kinds also employed many of these workers. Jobs for waiters

tended to be concentrated in those restaurants, hotel dining rooms, private clubs, and other establishments where meal service was formal.

Training, Other Qualifications, and Advancement

Although many waiters and waitresses do not have extensive schooling, more and more employers prefer that beginners have at least 2 or 3 years of high school. Home economics courses and special courses for waiters and waitresses, which are offered by some public and private schools, provide good preparation. Restaurant associations also offer training in this field. Unemployed and underemployed workers are trained for jobs as waiters and waitresses in several cities under provisions of the Manpower Development and Training Act.

Practically all newly hired workers without previous experience undergo a period of on-the-job training, during which they learn about the type of food service offered in their employer's establishment. Sometimes they work as busboys or busgirls before being assigned a station as a waiter or waitress.

Waiters and waitresses must be able to make the calculations necessary to total guests' checks and compute taxes. Personal appearance, a pleasant manner, an even disposition, and the ability to cope with the rush of business that usually occurs at mealtimes are very important. In a few restaurants, knowledge of a foreign language is desirable. Waiters and waitresses often are required by State law to obtain health certificates to assure that they are free of communicable diseases. Physical stamina also is needed because they are on their feet during their working hours.

In many small eating places, opportunities for promotion are limited. However, after gaining experience, a waiter or waitress may transfer to a larger restaurant where earnings and prospects for advancement are likely to be better. Advancement may be to a position as cashier or to supervisory work as a headwaiter or hostess. Some supervisory workers eventually advance to managerial positions.

Employment Outlook

Employment of waiters and waitresses is expected to increase moderately throughout the 1970's. Most openings, however, will result from the need to replace experienced workers who retire, die, or leave their jobs for other reasons.

A substantial increase in the consumption of food outside the home is expected as a result of population growth, higher personal incomes, more vacation and business travel, and other factors. Eating places which employ waiters and waitresses, however, will share only part of the additional business. Some of it will be handled by the growing number of food and beverage vending machines, and some of it will go to the drug stores, variety stores, and cafeterias where meal service is provided by counter and fountain workers instead of waiters and waitresses.

Most job openings will be for waitresses. The turnover of waitresses is particularly high because many of them leave their jobs to take care of family responsibilities. Jobs for waiters have become more concentrated in formal restaurants where hiring standards are high and turnover is usually low, and this trend is expected to continue. Both waiters and waitresses seeking jobs in formal restaurants will find competition keen for the jobs that become available. Beginners will find their best opportunities for employment in the thousands of restaurants where food service is less elaborate.

Earnings and Working Conditions

Because most waiters and waitresses receive tips from the guests they serve, as well as wages paid by their employers, estimating average weekly earnings is difficult. Wages generally are lower than in other occupations, and the amount received in tips is usually somewhat greater than wages. Tips vary greatly in amount, however, depending on the skill of the waiter or waitress, the tipping customs in the community, and especially on the type of restaurant. Because tips often average between 10 and 15 percent of guests' checks, earnings from tips are usually highest in restaurants where prices are also highest.

Limited data from union-management contracts in effect in 1970, covering eating and drinking places in several large cities, provide an indication of earnings (excluding tips). In these contracts, straight-time hourly rates for waiters and waitresses ranged from $0.82 to $2.15. However, many waiters and waitresses are not covered by union-management contracts, and hourly rates in large cities generally are higher than those in small towns.

The majority of waiters and waitresses receive free meals at work. Many also are furnished with uniforms. Paid vacations, after qualifying periods of service, are customary, and various types of health, insurance, and pension plans also may be offered.

Waiters and waitresses often work split shifts—that is, they work for several hours during the middle of the day, take a few hours off in the afternoon, and then return to their jobs for the evening hours. Scheduled hours often include work on holidays and weekends. Large restaurants and dining rooms usually are furnished comfortably with convenient working areas, and are often air conditioned. Workers in other eating places—particularly small ones—may find working conditions less desirable, and the pace of work very rushed at times. In restaurants of all types, workers often spend long periods on their feet and may be required to lift heavy trays. Work hazards include the possibility of burns and cuts.

The principal union organizing waiters and waitresses is the Hotel & Restaurant Employees and Bartenders International Union.

Sources of Additional Information

Information about job opportunities may be obtained from local employers, locals of the union previously mentioned, and local offices of the State employment service. The State employment service also may be a source of information about the Manpower Development and Training Act and other programs that provide training opportunities. General information about restaurant waiters and waitresses is available from:

Educational Director, National Restaurant Association, 1530 North Lake Shore Dr., Chicago, Ill. 60610.

BARTENDERS

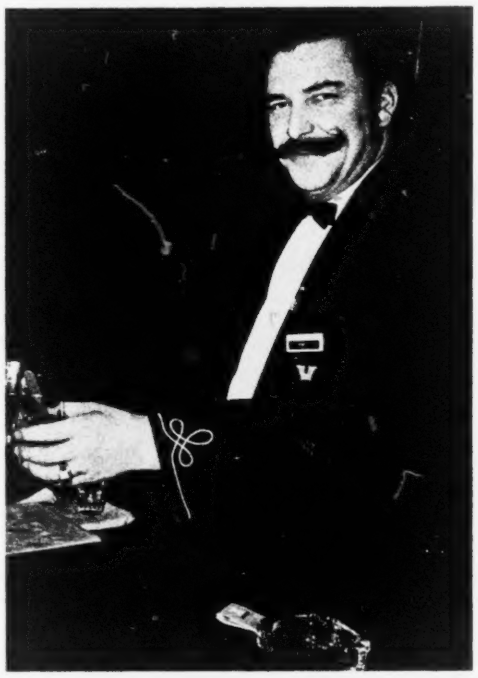
(D.O.T. 312.878)

Nature of the Work

Although they may work in settings as varied as a neighborhood tavern, a discotheque, or a luxurious hotel lounge, all bartenders perform essentially similar functions. Their primary duties are to mix and serve a variety of alcoholic and nonalcoholic beverages by combining ingredients such as liquor, soda, water, sugar, bitters, and fruit garnishes. They also serve wine and draft or bottled beer.

Some bartenders handle the drink-buying transaction from beginning to end. They take the order, prepare the drink, collect the payment, and make proper change. Others, who work at service bars, simply prepare the drinks that are served by waiters or waitresses.

In addition to preparing and serving drinks, bartenders may be responsible for ordering and maintaining an inventory of liquor and supplies; preparing an attractive display of bottled goods and glasses; washing glassware; and cleaning the bar. They also may prepare fruit for garnishing drinks (for example, slice limes and oranges) and prepare and serve appetizers for the patrons at the bar.



Larger establishments customarily employ bar boys or *bartender helpers* (D.O.T. 312.887) who assist bartenders by replenishing supplies such as liquor, fruit, and ice; stocking refrigerators with wines and beer; replacing empty beer kegs with full ones; and washing equipment and polishing fixtures. In addition, they mop floors and remove empty bottles and trash.

Places of Employment

Approximately 160,000 bartenders were employed in 1970. Nearly one-third of them were self-employed. Most bartenders work in restaurants and bars; others work in hotels, entertainment and recreation places, and private clubs.

Several thousand persons tend bar part-time. They usually have full-time jobs in other occupations or attend college. Some of them serve drinks at banquets and private parties; bartenders' unions often are clearing houses for these temporary jobs. About 1 out of every 4 bartenders is a woman. Most of them work in small establishments.

Most bartenders are employed in the urban population centers of New York, California, and other large States, but many also are employed in small communities. Vacation resorts offer seasonal employment, and some bartenders alternate between summer and winter resorts rather than remain in one area the entire year.

Training, Other Qualifications, and Advancement

Most bartenders learn their trade on the job. Practice in preparing drinks at home can be helpful, but more practical experience can be gained by working as a bar boy or bus boy. They have an opportunity to observe the bartender at work; and, when he has time to give instructions, can learn how to prepare drinks and perform other tasks. Working as a waiter also can be valuable training for this occupation.

Some private schools offer short courses in bartending that include instructions on State and local laws and regulations, cocktail recipes, attire and conduct, and how to properly stock the bar. Some schools maintain a placement service for their students.

Manual dexterity, accuracy, and speed are required in order to prepare the proper mix, especially at times when the demand is heavy. Physical stamina is important, because the bartender works on his feet and may have to lift heavy kegs or cases. Because bartenders deal with the public, a pleasant personality is an important qualification.

Twenty-one is generally the minimum age required by law for employment as a bartender. Some employers, however, prefer their bartenders to be at least twenty-five. Some States require bartenders to obtain health certificates to assure that they are free of communicable diseases. In some instances, they must be bonded.

Beginners usually find the best entry opportunities in small establishments and resorts. After gaining experience, a bartender may transfer to a larger establishment where earning prospects are likely to be better. In these places they may advance to head bartender or food and beverage manager. Some bartenders with business know-how become proprietors of their own establishments.

Employment Outlook

Employment of bartenders is expected to increase moderately through the 1970's. In addition to employment growth, several thousand job openings will arise annually from the need to replace experienced bartenders who retire, die, or transfer to other occupations.

Most of the increase in demand for bartenders will occur as new restaurants and hotels are established to meet the needs of a growing population. Higher average incomes and more leisure time have resulted in increased vacation travel, and extensive business travel has become common. Also, with a greater proportion of women in the labor force, families often find dining out a welcome convenience. These factors are expected to contribute to a significant increase in consumption of food and beverages outside the home.

While technology has had little effect on this occupation, an automated liquor and cocktail mixing unit recently has been introduced and is being tested at several locations. The unit delivers a predetermined amount of liquor, or mixes and dispenses a variety of cocktails when the bartender presses a button. This type of device could increase bartender efficiency and also reduce skill requirements.

Earnings and Working Conditions

Limited data from union-management contracts in the restaurant industry indicate that straight-time hourly earnings of bartenders ranged from $2.09 to $3.87 in 1970, depending on experience, geographic location, and type of establishment. In addition to salaries, bartenders at public bars receive tips that generally increase earnings substantially. Since bartenders at service bars do not receive tips, some establishments provide wage differentials to increase their earnings.

Bartenders often receive free meals at work and may be furnished bar jackets or complete uniforms. Paid holidays and vacations are customary as are various types of employee benefits such as health and accident insurance and pension plans.

Many bartenders work more than 40 hours a week, but there is a trend toward fewer hours. Night and weekend work and split shifts are common. For many bartenders, however, the opportunity to socialize with customers and the possibility of someday managing or owning a bar or restaurant more than offset these disadvantages. For others, the opportunity to get part-time employment is important.

Sources of Additional Information

Information about job opportunities may be obtained from locals of the Hotel & Restaurant Employees and Bartenders International Union, which is the principal union organizing bartenders. Additional information about job opportunities may be available at local offices of the State employment service.

GUARDS AND WATCHMEN

(D.O.T. 372.868)

Nature of the Work

Guards and watchmen patrol and inspect property to protect it against fire, theft, vandalism, and illegal entry. The specific duties of these workers, however, vary by size, type, and location of employer.

In office buildings, banks, hospitals, and department stores, guards and watchmen are responsible for the security of records, merchandise, money, and office machines and other equipment. Department store guards may work with plainclothesmen in watching for shoplifters and spotting theft by store employees.

At ports and railroads, guards and watchmen protect merchandise in shipment as well as property and equipment. They make sure that nothing is stolen while being loaded or unloaded, and guard against fires, prowlers, and trouble among work crews. Sometimes, they examine papers of truckers hauling goods, or direct and control traffic.

Guards who work in public buildings such as museums or art galleries, protect paintings or exhibits from fire, theft, or damage. They also answer routine questions asked by visitors, and sometimes guide traffic.

In large factories, aircraft plants, and defense installations where valuable information must be protected, some guards are assigned to entrances where they check the credentials of persons and vehicles entering and leaving the premises. Similar duties often are performed by university, park, or recreation guards who also may issue parking permits and direct traffic.

At social affairs, sports events, conventions, and other public gatherings, guards maintain order, give information, and watch for suspicious persons.

In a large organization, guards may serve under a security officer who is in charge of the guard force; in a small organization, a single watchman may be responsible for security. Patrolling is usually done on foot, but if the property is large, guards or watchmen may make their rounds by car or motor scooter.

As they make their rounds, guards and watchmen check all doors and windows, see that no unauthorized persons remain after working hours, and insure that fire extinguishers, alarms, sprinkler systems, furnaces, and various electrical and plumbing systems are working properly.

Although most guards and watchmen are not expected to do janitorial work, they sometimes set thermostats or turn on machines for workers.

Guards and watchmen usually are uniformed and often carry a nightstick or gun. They also may carry a flashlight, whistle, two-way radio, and a watch clock—a device that indicates the time they reach various check-points.

Places of Employment

Over 200,000 guards and watchmen were employed in 1970; about 90 percent were men.

The largest number of guards and watchmen are found in office buildings, defense installations and other government buildings, hospitals, nursing homes, hotels, banks, and schools. Many guards and watchmen in these places work for private guard companies. Large numbers of guards and watchmen also work in various manufacturing industries such as automobiles, aerospace, steel, and rubber.

Although guard and watchman jobs are found throughout the country, the largest numbers are located in highly industrialized areas.

Training, Other Qualifications, and Advancement

These workers have no specific educational requirements but most employers prefer guards and watchmen who are high school graduates. Employers also seek people who have experience in the military police or in State and local police departments. Applicants who have less than a high school education usually are tested for their reading and writing ability, and their competence in following written and oral instructions. Candidates for guard and watchman jobs in the Federal Government must be veterans, have some experience as guards, and pass a written examination. For most Federal guard positions, applicants must qualify in the use of firearms. A driver's permit is required for some jobs.

Many companies give newly hired guards pre-job instruction and several weeks of on-the-job training. For example, guards may be taught the use of firearms, the administration of first aid, the handling of various emergencies, and ways to spot and deal with various security problems.

Applicants are expected to have good character references; no police record; good health, especially hearing and vision; and good personal habits. Although many companies require guards to meet height and weight requirements, no age limits are specified. Depending upon the material or the property being protected, some employers prefer an older person as a guard, while others look for the young applicants who may better cope with intruders.

Mental alertness, emotional stability, and physical stamina are prerequisites for guards and watchmen since they must be aware of anything unusual and make split-second decisions when quick action is important and outside help is not available. Guards and watchmen must be dependable since they often are the only ones guarding property. Because guards and watchmen often are the first company employee to have contact with the public, they should be neat, pleasant, and courteous.

Although guards and watchmen in small companies receive periodic salary increases, advancement is likely to be limited. However, the military-type ranking of guards—from patrolman, through intermediate ranks, to captain—which exists in most big companies and public agencies, provides advancement in position and salary. Guards with some college education may advance to jobs involving administrative duties or to prevention and disclosure of espionage and sabotage.

Employment Outlook

The number of guards and watchmen is expected to grow moderately through the 1970's. Continuing increases in the number of plants, offices, banks, retail stores, and educational institutions needed to serve a growing population will create more jobs for guards and watchmen.

In addition, the mounting incidence of crime and vandalism is expected to increase the need for more guards and watchmen. Similarly, social unrest also would necessitate the increased use of these workers. In addition to new jobs resulting from employment growth, many thousands of openings will occur each year as workers retire, die, or leave their jobs for other reasons.

Earnings and Working Conditions

Earnings of guards and watchmen in private industry varied widely in 1970. Salaries ranged from a low of $74 for inexperienced persons working a 40-hour week in small protective service agencies, to over $180 a week for experienced workers and supervisors in large industrial plants.

Entrance salaries for guards employed in the Federal Government were $5,212 a year in 1970; experienced guards often earned $5,853 a year. Top supervisory guard positions in the Federal Government may pay up to $15,000 annually. These workers usually receive overtime pay as well as a wage differential for the second and third shift. Guards and watchmen usually receive benefits such as paid vacations, sick leave, and insurance and pension plans.

About two-thirds of all guards and watchmen work at night; the usual shift lasts 8 hours. Some employers, however, have three shifts, and in such cases guards are often rotated to divide daytime work, weekends, and holidays equally. Usually, guards and watchmen do not take a regular lunch break; instead, they eat on the job.

Working conditions vary and generally depend on whether most of the work is indoors or outdoors. In addition, since guards often work alone, they have no one to call if an accident or injury occurs. To reduce this hazard, some large firms use a central station watchman's reporting service which enables guards and watchmen to be in constant contact with the central station outside the plant. If they fail to transmit an expected signal, the central station investigates.

FBI SPECIAL AGENTS

(D.O.T. 375.168)

Nature of the Work

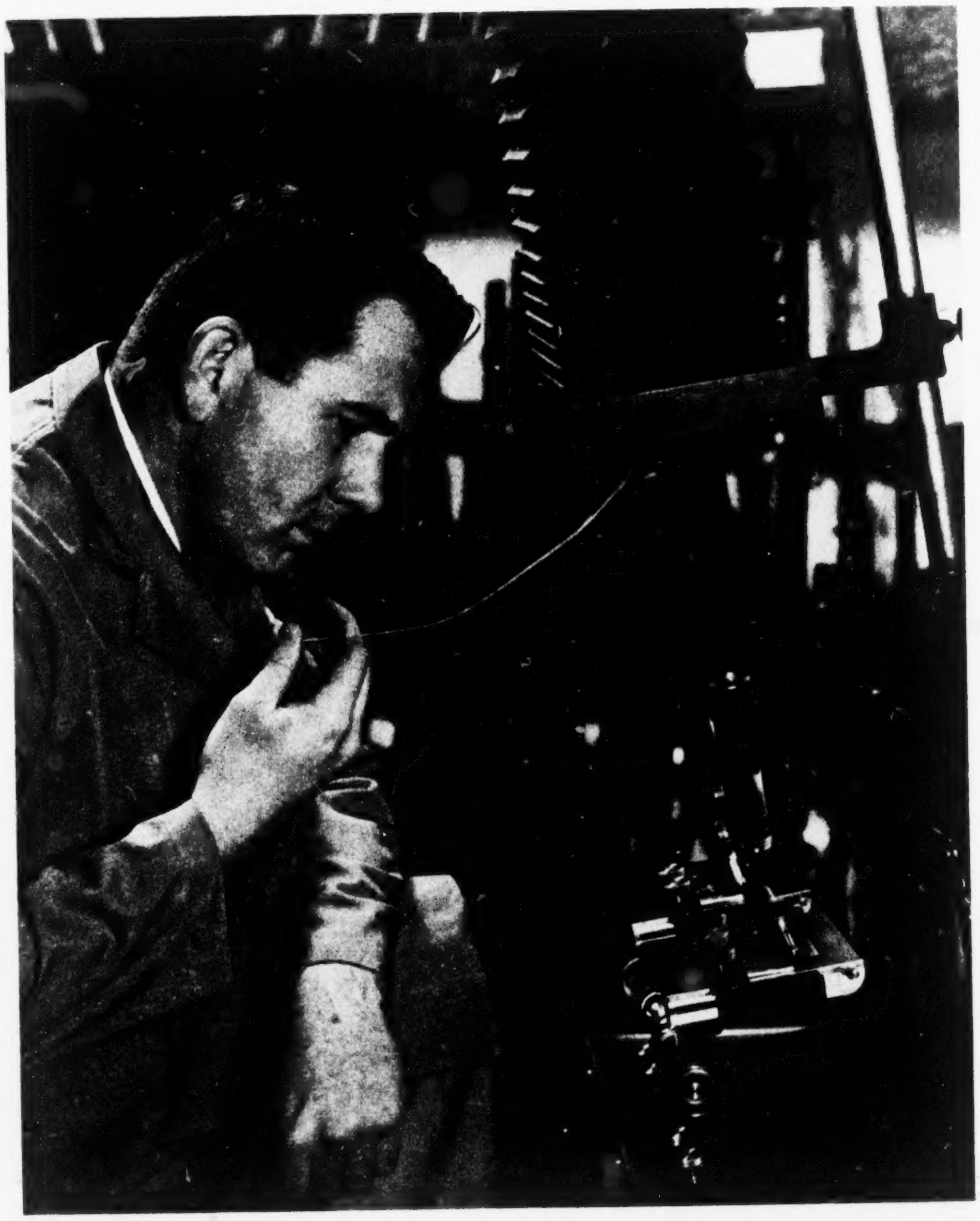
Federal Bureau of Investigation (FBI) Special Agents investigate many types of violations of Federal laws, such as bank robberies, kidnappings, frauds against the Government, thefts of Government property, espionage, and sabotage. The FBI, which is part of the U.S Department of Justice, has jurisdiction over more than 185 Federal investigative matters. Special Agents may be assigned to any type of case, but those having specialized training in accounting are likely to be assigned chiefly to cases involving complex financial records; for example, frauds involving Federal Reserve Bank records.

The FBI is a fact-gathering and fact-reporting agency, and its Special Agents function strictly as investigators. (Its authority does not include affording personal protection to individuals nor does it include police functions to assure that the law is obeyed. Such matters are within the purview of local and State law enforcement agencies.) To perform their duties, Special Agents may interview people, observe the activities of suspects, and participate in raids; their duties may involve extensive travel. Because of the highly confidential nature of the FBI's work, Special Agents may not disclose any of the information which they gather in the course of their official duties to unauthorized persons, including members of their families. Special Agents may have to testify in court about cases that they investigate, but they do not make recommendations pertaining to prosecution, express opinions concerning the guilt or innocence of suspects, nor issue "clearances" of any kind.

In most assignments, Special Agents work alone but must maintain continued contact with their superiors by radio or telephone. For potentially dangerous duties, such as arrests and raids, two agents or more are assigned to work together.

Places of Employment

Most of the more than 7,900 Special Agents employed in 1970 were assigned to the FBI's 59 field offices located throughout the Nation and in Puerto Rico. These agents work either in the city where the field office headquarters is lo-



cated or in resident agencies (suboffices) established under the supervision of the field office to provide prompt and economic handling of investigative matters arising throughout the field office territory. Some agents are assigned to the Bureau headquarters staff in Washington, D.C., which supervises all FBI activities.

Training, Other Qualifications, and Advancement

To be eligible for appointment as an FBI Special Agent, an applicant must have graduated from a State-accredited resident law school or a 4-year resident college with a major in accounting. The law school training must have been preceded by at least 2 years of resident undergraduate college work. Accounting graduates also must have had at least 3 years of experience in accounting or auditing or a combination of both.

Applicants for the position of FBI Special Agent must be male citizens of the United States, at least 23 and not more than 40 years of age, and willing to serve anywhere in the United States or Puerto Rico. They must be at least 5 feet 7 inches tall and capable of strenuous physical exertion; they must have excellent hearing and vision, normal color perception, and no physical defects which would prevent their using firearms or participating in dangerous assignments. Each applicant must pass a rigid physical examination, as well as written and oral examinations testing his knowledge of law or accounting and his aptitude for meeting the public and conducting investigations. All of the tests except the physical examinations are given by the FBI at its facilities. Exhaustive background and character investigations are made of all applicants. Appointments are made on a probationary basis and become permanent after 1 year of satisfactory service.

Each newly appointed Special Agent is given approximately 14 weeks of training before he is assigned to a field office. He receives most of this training at FBI headquarters at Washington, D.C., and the rest at the FBI Academy at the U.S. Marine Corps Base in Quantico, Va. During this period, he receives intensive training in defensive tactics and firearms. In addition, he is also thoroughly schooled in Federal criminal law and procedures, FBI rules and regulations, fingerprinting, and investigative work. After assignment to a field office, the new agent usually works closely with an experienced agent for a period of about 2 weeks before handling any assignments independently.

All administrative and supervisory positions are filled from within the ranks by selecting those FBI Special Agents who have demonstrated the ability to assume more responsible positions.

Employment Outlook

The FBI has experienced a substantial expansion in its jurisdiction over the years. Although it is impossible to forecast Special Agent personnel requirements, employment may be expected to increase with growing FBI responsibilities.

The FBI provides a career service and its rate of personnel turnover is traditionally low. Nevertheless, the FBI is always interested in applications from qualified men who would like to be considered for the position of Special Agent.

Earnings and Working Conditions

The entrance salary for FBI Special Agents in 1970 was $10,869 a year. FBI Special Agents are not appointed under Federal Civil Service regulations, but, like other Federal employees, they receive periodic within-grade salary raises if their work performance is satisfactory, and they can advance in grade as they gain experience. The top salary for regular field Special Agents in 1970 was about $23,000. Agents in supervisory and administrative positions received higher salaries.

Special Agents are subject to call 24 hours a day and must be available for assignment at all times and places. They frequently work longer than the customary 40-hour week and, under certain specified conditions, receive over-time pay up to a maximum of $2,870 a year. They are granted paid vacations, sick leave, and annuities on retirement.

Sources of Additional Information

The Federal Bureau of Investigation, U.S. Department of Justice, Washington, D.C. 20535.

POLICE OFFICERS

(D.O.T. 375.118 through .868 and 377.868)

Nature of the Work

Police officers—whether directing traffic at busy intersections or arresting dangerous criminals—are helping to preserve law and order. As local government employees, their job is to prevent criminal activities, to investigate crimes, and to apprehend and assist in the prosecution of offenders. Whether on or off duty, they are expected to exercise their authority whenever necessary. (This report covers policemen and policewomen employed by local governments. It does not include civilian employees of police departments; State and Federal Government police employees; or policemen and detectives employed by private businesses.)

The policeman who works in a small community handles many police duties. In the course of a day's work, he may direct traffic at the scene of a fire, investigate a housebreaking, and give first aid to an accident victim. In a large police department, officers usually are assigned to a specific type of police duty. Most policemen are detailed either to patrol or traffic duty; smaller numbers are assigned to special work, such as accident prevention or operating communications systems. Some officers are detectives (plain-clothesmen) assigned to criminal investigation; others are experts in chemical and microscopic analysis, firearms identification and hand-writing and fingerprint identification. In very large cities, a few officers may be trained to work with special units such as mounted and motorcycle police, harbor patrols, helicopter patrols, canine corps, mobile rescue teams and youth aid services.

An increasing number of city police departments include women on their police forces. These policewomen work with juvenile delinquents, try to locate lost children and runaways, or search, question, book, and fingerprint women prisoners. They may also be assigned to detective squads, where they work mainly on crimes involving women.

Most newly recruited policemen begin on patrol duty, which has become particularly important as a means of preventing crime and providing other services to the public. Patrolmen may be assigned to congested business districts, outlying residential areas, or other sections of a community. They may cover their beats alone or with other patrolmen, and they may ride in a police vehicle or walk on "foot" patrol. In any case, they become thoroughly familiar with conditions throughout their area and, while on patrol, remain alert for anything unusual. They note suspicious circumstances, such as open windows or lights in vacant buildings, as well as hazards to public safety such as burned-out street lights or fallen trees. Patrolmen also may watch for stolen automobiles and enforce traffic regulations. At regular intervals, they report to police headquarters through call boxes, by radio, or by walkie-talkie. They also prepare reports about their activities and may testify in court when cases result in legal action.

Places of Employment

An estimated 330,000 full-time policemen and policewomen were employed in 1970 by local police departments. The majority were men.

Some cities have very large police forces. For example, New York has over 31,000 police officers and Chicago has over 12,000. Hundreds of small communities employ fewer than 25 policemen each. Policewomen work mainly in large cities.

Training, Other Qualifications, and Advancement

Local civil service regulations govern the appointment of police officers in practically all large cities and in many small ones. Candidates must be U.S. citizens, usually at least 21 years of age, and be able to meet certain height and weight standards. Eligibility for appointment also is determined by performance on competitive examinations, physical and personal qualifications, and education and experience. The physical examinations often include tests of strength and agility. Because personal characteristics such as honesty, good judgment, and a sense of responsibility are especially important in police work, candidates usually are interviewed by a senior officer at police headquarters, and their character traits and background may be investigated. In some police departments, candidates also may be interviewed by a psychiatrist or a psychologist, or given a personality test. In large police departments, where most jobs are to be found, applicants usually must have at least a high school education. A few cities require some college training and some hire law enforcement students as police interns. Some police departments accept men who have less than a high school education as recruits, particularly if they have had work experience in a field related to law enforcement.

Police departments increasingly emphasize post-high school training in sociology, psychology, and minority group relations. As a result, more than 400 colleges and universities now offer major programs in law enforcement. Other courses considered helpful in preparing for a police career include English, American history, civics and government, business law, and physics. Physical education and sports activities are especially helpful in developing the physical stamina and agility needed for police work. College training may be required for policewomen because of their specialized assignments. Training or experience in social work, teaching, or nursing is desirable.

Young men who have completed high school can enter police work in some large cities as police cadets, or trainees, while still in their teens. As paid civilian employees of the police department, they attend classes part of the time to learn police science and they also do clerical work. When police cadets who qualify in other respects reach the age of 21, they may be appointed to the police force.

Before their first assignments, policemen usually go through a period of training. In many small communities, the instruction is given informally as recruits work for about a week with experienced officers. More extensive training, such as that provided in large city police departments, may extend over several weeks or a few months. This training includes classroom instruction in constitutional law and civil rights, as well as in State laws and local ordinances, and in the procedures to be followed in accident investigation, patrol, traffic control, and other police work. Recruits learn how to use a gun, defend themselves from attack, administer first aid, and deal with other emergencies.

Policemen and policewomen generally become eligible for promotion after specified periods of service. In a large department, promotion may enable an officer to specialize in one kind of law enforcement activity such as laboratory work, traffic control, communications or work with juveniles. Promotions to the rank of sergeant, lieutenant, and captain are made according to each candidate's position on a promotion list, as determined by his performance on written examinations and his work as a police officer. Advancement opportunities generally are most numerous in large police departments, where separate bureaus work under the direction of administrative officers and their assistants.

Many types of training help police officers improve their performance on the job and prepare for advancement. Through training given at police department academies, and at colleges and other institutions, officers keep abreast of crowd-control techniques, civil defense, legal developments that affect policemen and advances in law enforcement equipment. Many police departments encourage officers to work toward college degrees, and some pay all or part of the tuition.

Employment Outlook

Employment opportunities for police officers are expected to be very favorable through the 1970's. Many new positions will arise as cities increase the size of their police forces to meet the needs of a growing population. More openings, however, will occur as policemen and policewomen retire or leave their jobs for other reasons. Police officers usually retire at a somewhat younger age than workers in most other occupations, and replacement rates are relatively high for this reason.

Police employment is expected to rise moderately during the 1970's as population and economic growth create a need for more officers to protect life and property, regulate traffic, and provide other police services. Future police jobs are likely to be affected by changes now occurring in police methods and equipment. Specialists are becoming more essential to the effective operation of city police departments. In an increasing number of departments, for example, electronic data processing is used to compile administrative, criminal, and identification records, and to operate emergency communications systems. Many departments also need officers with specialized training to apply engineering techniques to traffic control and social work techniques to crime prevention. At the same time, the use of automatic signal lights has somewhat reduced the number of policemen needed for directing traffic.

Earnings and Working Conditions

In 1970, entrance salaries for police officers averaged $8,500 a year, according to survey information. The earnings of more experienced officers averaged $10,000 annually.

Most policemen and policewomen receive regular pay increases during the first few years of employment until a specified maximum is reached. Sergeants, lieutenants, and captains are paid progressively higher basic salaries than patrolmen in the same police departments. Top salaries are paid to police chiefs or commissioners, and in 1970 their salaries averaged $11,000 a year in some small cities and $23,000 in the largest.

Police departments usually provide officers with special allowances for uniforms and furnish revolvers, night sticks, handcuffs, and other required equipment.

The scheduled workweek for police officers usually is 40 hours, and in localities where the workweek is longer weekly hours gradually are being reduced. Police protection must be provided around the clock; therefore, in all but the very smallest communities, some officers are on duty over weekends, on holidays, and at night. Policemen are subject to call at any time their services may be needed and in emergencies may work overtime. In some departments, overtime is paid at straight time or at time and a half; in others, officers may be given an equal amount of time off on another day of the week.

Police officers generally are covered by liberal pension plans, enabling many to retire at half pay by the time they reach age 55. Paid vacations, sick leave, and medical, surgical, and life insurance plans are among the other benefits frequently provided.

Policemen may be assigned to work outdoors for long periods in all kinds of weather. The injury rate is higher than in many occupations and reflects the risks police officers take in pursuing speeding motorists, capturing lawbreakers, and dealing with public disorder.

Sources of Additional Information

Information about local entrance requirements may be obtained from local civil service commissions or police departments.

Additional information on the occupation of policeman or policewoman may be obtained from:

International Association of Chiefs of Police, 11 Firstfield Road, Gaithersburg, Md. 20760.

Fraternal Order of Police, Pick-Carter Hotel, 1012 Prospect Ave., Cleveland, Ohio 44115.

Further information on the salaries and hours of work of policemen in various cities is published by The International City Managers' Association in its *Municipal Yearbook*, and by the Fraternal Order of Police.

STATE POLICE OFFICERS

(D.O.T. 375.118, .138, .168, .228, .268, and .388)

Nature of the Work

State policemen (sometimes called State highway patrolmen or troopers) are protective service officers whose primary responsibility is to enforce the laws and regulations governing the use of highways. Officers spend most of their time patroling highways to insure that traffic laws are obeyed and issuing traffic tickets to motorists who violate the laws. When necessary, they testify in court.

State police officers assist at the scene of traffic accidents. They give first aid to injured persons, summon ambulances and other emergency equipment, and direct traffic to avoid additional accidents. Patrolmen conduct investigations of accidents and write reports containing information that may be used as legal evidence in determining cause and liability. In addition, State police officers provide services to motorists on the highways. For example, they radio for road service in case of mechanical trouble, direct tourists to their destination, or pro-

State police officer investigates accident.

vide information about lodging, restaurants, and tourist attractions.

State police officers also direct traffic during road repairs, fires, and other emergencies, as well as for special occurrences such as parades, celebrations, and sporting events. They sometimes check the weight of commercial vehicles, conduct driver examinations, and serve as public safety information officers.

In some States, these policemen may investigate crimes such as thefts, murders, and narcotics violations. However, the jurisdiction of the State police in such matters usually is limited to those areas that do not maintain their own police forces. Nevertheless, they sometimes assist municipal or county police forces in criminal investigations, the apprehension of lawbreakers, and the control of civil disturbances and riots.

Some police officers spend part or all of their time in specialized work. These specialties include fingerprint classification, chemical or microscopic analysis, instruction of trainees in State police schools, and piloting police aircraft. Others work with special State police units such as the mounted police, canine corps, and marine patrols.

State police officers also have clerical duties. They prepare reports and maintain police records. Some officers are administrators, including division or bureau chiefs responsible for training or investigation, and those who command police operations in an assigned area.

Places of Employment

About 40,000 State police officers—virtually all men—were employed throughout the 49 States that maintained a police force in 1970. The size of State police forces varies considerably. The largest force (in California) has over 5,000 officers. The smallest (in North Dakota) has fewer than 100.

Training, Other Qualifications, and Advancement

State civil service regulations govern the appointment of State police officers. All candidates must be citizens of the United States. Other entry requirements vary by State, but most States require that applicants have a high school education or equivalent education and experience and be at least 21 years of age.

State police officers must pass a competitive examination and meet physical and personal qualifications. Physical requirements include standards of height, weight, and eyesight. Tests of strength and agility often are required. Since personal characteristics such as honesty and a sense of responsibility are especially important in police work, an applicant's character traits and background are investigated.

In all States, recruits enter a formal training program for a period of several months. The minimum period of training usually is 12 weeks. Recruits receive classroom instruction in State laws and jurisdictions. They also study procedures for accident investigation, patrol, traffic control, and other police work.

They learn to use a gun, defend themselves from attack, handle an automobile at high speeds, administer first aid, and deal with other emergencies. After gaining experience, some State police officers take advanced or specialized training in police science, administration, law enforcement, or criminology. Classes are held at junior colleges, colleges and universities, or special police institutions such as the National Academy of the Federal Bureau of Investigation.

High school and college courses in English composition, reading comprehension, American history, civics and government, psychology, sociology, and physics are helpful in preparing for a police career. Physical education and sports activities are useful, for they develop needed stamina and agility. Completion of a driver education course and training received in military police schools also are assets.

Police officer recruits serve a probationary period from 6 months to 2 or 3 years. After a specified period of time, State police officers become eligible for promotion. Most States have merit promotion systems requiring officers to pass a competitive examination to qualify for the next highest rank. Although the organization of State police forces differs among States, the typical avenue of advancement is from private to corporal, to sergeant, to first sergeant, to lieutenant, and then to captain. Police officers who demonstrate administrative ability may be considered for higher level positions such as commissioner or director.

In some States, high school graduates may enter State police work as police cadets. These paid civilian employees of the police organization attend classes to learn various aspects of police work and are assigned nonenforcement duties. Cadets who qualify may be appointed to the State police force at age 21.

Employment Outlook

State police employment is expected to rise very rapidly through the 1970's. Hundreds of job openings are expected to result each year from growth in employment requirements; a somewhat smaller number of openings will arise as officers retire, die, or leave the occupation for other reasons.

Although some State police will be needed in criminal investigation and other nonhighway functions, the greatest demand will be for officers to work in highway patrol and related activities. This is the result of a growing and more mobile population. Along with an increasing number of motor vehicles, the nature of highway systems is rapidly changing. Limited access highways require increased police patrol to control high speeds, prevent accidents, and assist stranded motorists. The newer dual highways also require more patrolmen, since officers can patrol effectively only one side of these roads.

Because law enforcement work is becoming more complex, some specialists will be needed to work in crime laboratories and electronic data processing centers to create better administrative and criminal information systems.

Earnings and Working Conditions

In 1970, entrance salaries for State policemen ranged from $480 to about $800 a month, according to a private survey. The most common entry rates ranged from $500 to $700 per month. Average monthly starting rates are highest in the Western States and lowest in the South.

State policemen generally receive regular salary increases, based on experience and performance, until a specified maximum is reached. The 1970 maximums ranged from $640 to $1,100 a month; the most common maximum rates ranged from $700 to $900 a month. Earnings may increase above these levels with promotions to a higher rank, such as corporal or sergeant.

State police agencies usually furnish officers uniforms, firearms, and other necessary equipment, or provide special allowances for their purchase.

In most States, the scheduled workweek for police officers is 40 hours. Although the workweek is longer in some States, weekly hours in excess of 40 rapidly are being reduced. In a few States, officers are paid overtime. Since police protection must be provided around the clock, some officers are on duty over weekends, on holidays, and at night. Police officers also are subject to emergency calls at any time.

State police usually are covered by liberal pension plans. Paid vacations, sick leave, and medical, surgical, and life insurance plans frequently are provided.

The work of State police officers sometimes is hazardous. They always run the risk of an automobile accident while pursuing speeding motorists or fleeing criminals. Police officers also face the risk of bodily harm while apprehending criminals or controlling disorders.

Sources of Additional Information

Information about specific entrance requirements may be obtained from State civil service commissions or State police headquarters, usually located in each State capitol.

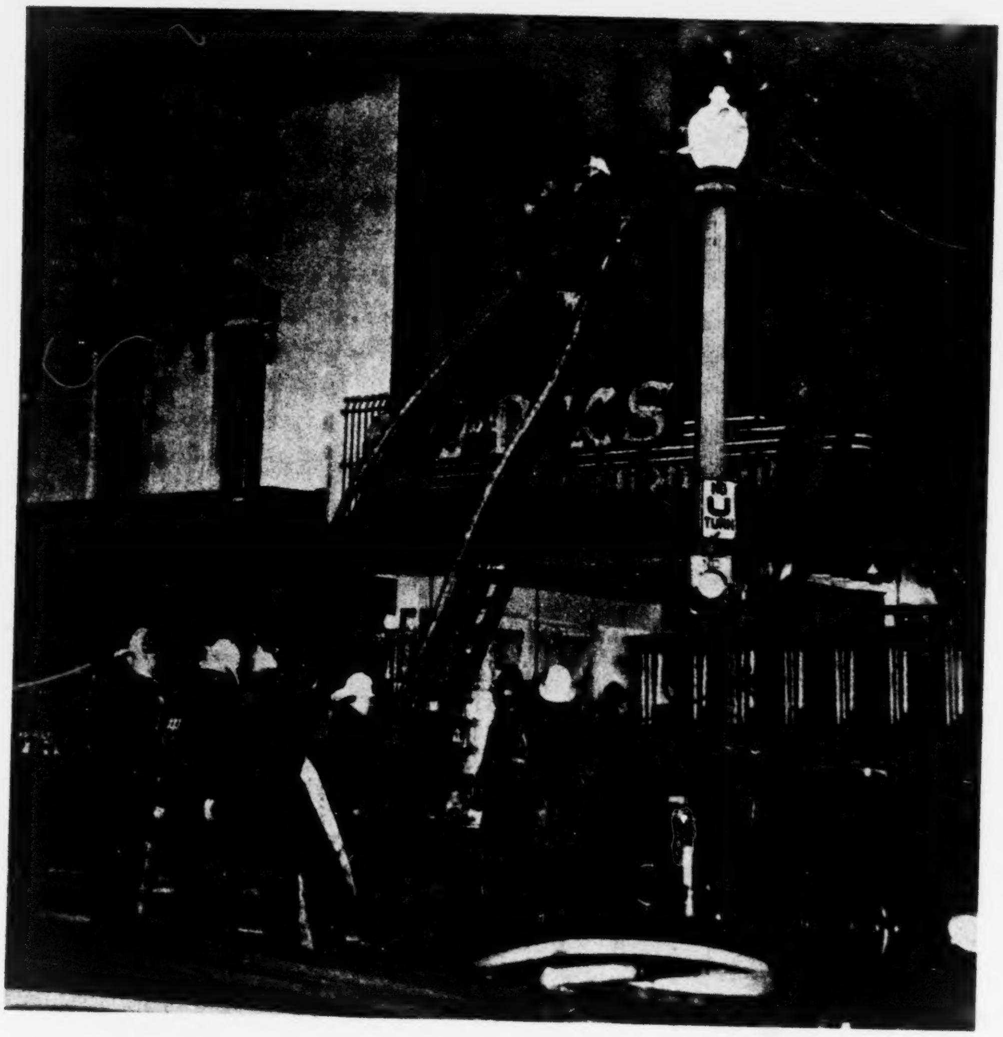
FIREFIGHTERS

(D.O.T. 373.118 through .884)

Nature of the Work

Firefighters help protect us from fires that claim thousands of lives and cause extensive property damage each year. This statement gives information about firefighters who are full-time paid employees of city and town fire departments. It does not cover part-time volunteer firemen and "call men" who serve only when the alarm signals that they are needed.

While on duty, firefighters must be prepared at a moment's notice, to rush to a fire and handle any emergency that occurs. Because firefighting is dangerous and complicated, it requires teamwork and must be well organized. At every fire, firefighters perform specific jobs assigned to them by a commanding officer; they may connect hose lines to hydrants, operate a pressure pump, position ladders, or perform some other duty. Furthermore, the assigned duties of individual firefighters may be changed several times while the company is in action. Under emergency conditions firefighters are often called on to use their own initiative and judgment. They must, therefore, be proficient in many different kinds of firefighting activities. They also must be able to help people to safety and administer first aid.



Fire prevention is another important responsibility of municipal fire departments. Specially trained personnel inspect public buildings for conditions that might cause a fire and for compliance with local regulations relating to fire escapes, fire doors, storage of flammable materials, and other possible hazards. Educating the public about fire prevention and safety measures is also a part of the firefighter's job. Frequently, they speak on this subject before school assemblies and civic groups. In many communities, they regularly inspect private homes, at the owner's request, to point out possible fire hazards.

Between alarms, firefighters spend considerable time at their local stations, improving their knowledge of firefighting and doing maintenance work. They also participate in practice drills, clean and lubricate firefighting equipment, stretch hoses to dry, stand watch at fire alarm instruments, and verify and record alarms.

Places of Employment

There were 180,000 firefighters employed in 1970 by municipal fire departments. In addition, thousands of paid "call men" and hundreds of thousands of part-time volunteer firemen are organized in small towns and rural communities throughout the Nation to help fight fires. A few very large cities have several thousand firemen; some small cities have fewer than 25.

Training, Other Qualifications, and Advancement

To become eligible for an appointment as a firefighter, an applicant must pass a written intelligence test, a medical examination, and tests of strength, physical stamina, and agility, as specified by local civil service regulations. In most communities, these examinations are open only to men who are at least 21 years of age, meet certain height and weight requirements, and have a high school education. The men who receive the highest grades on their examinations have the best chances for appointment. Extra credit usually is given for military service. Experience gained as a volunteer fireman or through firefighting training in the Armed Forces also may improve an applicant's chances for appointment.

As a rule, beginners in large fire departments are given training for several weeks at the city's fireschool. Through classroom instruction and practice drills, the recruits study such fundamentals as firefighting techniques, local building codes, fire prevention, and first aid; and learn about the use of axes, chemical extinguishers, ladders, and other firefighting equipment. Upon completion of this training, they are assigned to local fire companies. Opportunities for promotion are good in most fire departments. As firefighters gain experience, they may advance to higher ratings, and, after 5 to 10 years or more of service, become eligible for promotion to the grade of lieutenant. The line of further promotion is usually to captain, then battalion chief, assistant chief, and finally to chief. Chances for advancement generally depend upon each candidate's position on the promotion list, as determined by his rating on a written examination, his work as a fireman, and his seniority. Throughout their service, many firefighters continue to study fire prevention and related subjects to improve their performance on the job and prepare for promotional examinations. Programs conducted by many State governments and city fire departments throughout the country provide training of this kind for tens of thousands of firefighters each year. Some universities offer courses in fire engineering.

Among the important personal qualities of firefighters are mental alertness, courage, mechanical aptitude, endurance, and a sense of public service. Initiative and good judgment are extremely important, because firefighters often must make quick decisions. Leadership qualities are valuable assets for officers, who have the responsibility for establishing and maintaining a high degree of discipline and efficiency, as well as planning and directing the activities of the firefighters in their companies.

Employment Outlook

Several thousand openings for firefighters are expected to occur each year through the 1970's. Many openings will arise from the need to replace men who retire, die, or otherwise leave the occupation. Firefighters often are permitted to retire at an earlier age than people in many other occupations. New jobs also will become available as city fire departments enlarge their staffs and as paid departments replace volunteer fire companies in smaller, growing communities. In addition, some openings probably will be created as city fire departments continue to shorten the hours that firemen are on duty.

The number of young men who qualify for firefighter jobs in large cities usually is greater than the number of job openings, even though the written examination and physical requirements eliminate many applicants. Competition among candidates is apt to be keen since employment in this occupation is very stable.

The number of firefighters is expected to increase rapidly to meet the needs for fire protection in growing urban communities. As cities become more crowded, however, officials will give more emphasis to activities associated with fire prevention, and many firefighters will spend a greater amount of their time inspecting buildings for compliance with fire regulations and participating in fire prevention campaigns.

Earnings and Working Conditions

Firefighters in larger cities usually receive the highest starting salaries. In 1970 the average salary for beginning firefighters was about $7,800 a year in cities which had populations of more than 500,000. In cities which had populations of 10,000 to 25,000, the average annual starting salary was about $6,100.

Experienced firefighters also usually earn more money in the larger cities. In cities of over 500,000 persons, the average salary received by experienced firefighters was $9,200 a year. In nearly all other cities, the average salary received was over $7,000 a year.

In 1970, fire chiefs were receiving average salaries of $9,600 a year in the smaller cities and $21,600 a year in cities that had populations over 250,000.

Practically all fire departments furnish pay allowances for protective firefighting clothing (helmets, boots, and rubber coats) and many also provide dress uniforms.

In some cities, firemen are on duty for a 24-hour shift, then off for 24 hours, and receive an extra day off at intervals. In other cities, the day shift is 10 hours and the night shift is 14 hours, and firemen rotate shifts at frequent intervals. Firemen's hours range from 40 a week in some cities to 60 in others; the national average workweek is about 56 hours. Duty hours usually include some time when firemen are free to read, study, or pursue other personal interests.

In addition to their scheduled hours, firefighters must work as many extra hours as necessary to bring a fire under control. When overtime is worked, most city fire departments either give compensatory time off or extra pay for the additional hours.

The job of a firefighter involves risk of life or injury from sudden cave-ins of floors or toppling walls, as well as hazards associated with exposure to flames, smoke, and bad weather. In fighting fires in industrial establishments, firefighters may come in contact with poisonous, flammable, and explosive gases and chemicals.

Firefighters generally are covered by liberal pension plans, many of which provide for retirement at half pay at age 50 after 25 years of service, or at any age if disabled in the line of duty. Firefighters also receive paid vacations. Provisions for sick leave usually are very liberal; health and surgical benefit plans are offered in many fire departments; and compensation also is provided for firefighters injured in the line of duty. Most fire departments either allow paid holidays—ranging up to 11 or more a year—or time off for working on holidays.

Most firefighters are members of the International Association of Fire Fighters (AFL–CIO).

Sources of Additional Information

Information on how to obtain a job as a firefighter may be secured from your local civil service commission or fire department.

General information on the occupation may be obtained from:

International Association of Fire Fighters, 905 16th St. NW., Washington, D.C. 20006.

International Association of Fire Chiefs, 1725 K Street, NW., Washington, D.C. 20006.

Additional information on the salaries and hours of work of firemen in various cities is published annually by The International City Managers Association in its *Municipal Yearbook,* available in many libraries.

HOSPITAL ATTENDANTS

(D.O.T. 355.687 through 355.887)

Nature of the Work

Under the direction of registered nurses and licensed practical nurses, hospital attendants perform a variety of duties. Most require relatively little specialized training but contribute to the comfort and care of patients. The help they provide enables nurses to devote more time to work that requires professional and technical training.

Women employed as hospital attendants usually are called nursing aides and men often are known as *orderlies.* Other job titles include *nursing assistant, auxiliary nursing worker,* and (in mental institutions) *psychiatric aide.*

Nursing aides answer patients' bell calls and deliver messages, serve meals, feed patients who are unable to feed themselves, make beds, and bathe or dress patients. They also may give massages, take temperatures, and assist patients in getting out of bed and walking. Orderlies provide many of the same services for male patients and, in addition, perform tasks such as wheeling patients to operating and examining rooms, and transporting and setting up heavy equipment. Attendants also may perform tasks less directly associated with patient care such as working in hospital pharmacies or helping with sterile supplies.

The range of duties performed by hospital attendants depends on the policies of the institutions employing them, the type of patient being cared for, and—equally important—the capacities and resourcefulness of the nursing aide or orderly. In some hospitals, the nursing aide's work may include household tasks such as cleaning patients' rooms, whereas in others it may be limited to assisting in the care of patients. The tasks performed for patients differ considerably, depending on whether the patient is confined to his bed following major surgery, is learning to walk again after a disabling accident or illness, or requires assistance with daily activities because of infirmity caused by advanced age.

Places of Employment

An estimated 830,000 attendants were employed in 1970; more than four-fifths were women. Most of them worked in hospitals. Others were employed primarily in nursing homes, and other institutions providing facilities for care and recuperation.

Training, Other Qualifications, and Advancement

Although some employers hire persons with less than a high school education as hospital attendants, high school graduates are preferred. Many employers accept applicants 17 or 18 years of age. Others—particularly in nursing homes and in mental hospitals—prefer to hire more mature men and women who are at least in their mid-twenties.

Hospital attendants generally are trained after they are hired. In some institutions, on-the-job training under the close supervision of registered and licensed practical nurses is combined with classroom instruction that includes demonstrations in taking and recording temperatures, bathing patients, changing linens on beds which are occupied by patients, and moving and lifting patients. Training may last several days or continue over a period of a few months, depending on the policies of the hospital, the attendant's aptitude for the work, and the nature of the duties assigned. Many training programs for hospital attendants are aided by funds provided by the Manpower Development and Training Act and the Vocational Education Act.

Courses in home nursing and first aid, offered by many public school systems and other community agencies, provide a useful background of knowledge for the work. Volunteer work and temporary summer jobs in hospitals and similar institutions also may furnish helpful experience. Applicants for this work should be in good health. Personal qualities, such as tact, patience, understanding, emotional stability, and dependability are important. For work as an attendant, as in other health occupations, a basic requisite is a genuine interest in people and a desire to be of help to them. Also, persons planning to become hospital attendants should be willing to accept menial tasks.

Promotional opportunities are limited for hospital attendants, unless they undertake further training. Some may prepare for better paying positions such as hospital operating room or oxygen technician by acquiring specialized training.

In order to become licensed practical nurses, hospital attendants must complete the year of training required for licensure. (See statement on "Licensed Practical Nurses" elsewhere in the Handbook.)

Employment Outlook

Employment of hospital attendants is expected to increase very rapidly through the 1970's. In addition to those needed for occupational growth, many thousands of hospital attendants will be needed each year to replace those who die, retire, or leave the occupation for other reasons.

Most new jobs for nursing aides and orderlies during the 1970's will be in hospitals, but many openings also will occur in nursing homes, convalescent homes, and other long-term care facilities. A major reason for expected occupational growth is the increasing need for medical care of a growing population, including a larger proportion of elderly people (a group particularly susceptible to long-term illness). Combined with this will be an increasing ability of persons to pay for health care because of rising incomes, the growth of health insurance plans (both public and private), and the expansion of medical care services to the elderly through Medicare and to the poor through Medicaid. Important also will be the emphasis being placed on rehabilitation in mental hospitals and other institutions. In addition, employment opportunities will arise as hospitals continue to delegate to attendants tasks which, although associated with patient care, do not require the training of registered and licensed practical nurses.

Earnings and Working Conditions

Weekly earnings of hospital attendants averaged $80.50 in State and local hospitals and $74 in nongovernment hospitals in early 1969, according to a survey conducted by the Bureau of Labor Statistics. Attendants employed full time by nursing homes and related facilities earned considerably less than those in hospitals. Salaries of inexperienced hospital attendants in Veterans Administration hospitals started at $89 a week in 1970.

In some institutions, free lodging may be furnished hospital attendants. Free meals or meals at cost, as well as uniforms and laundering of uniforms, also are provided hospital attendants in some institutions.

With few exceptions, the scheduled workweek of attendants in hospitals is 40 hours or less. Because nursing care must be available to patients on a 24-hour-a-day basis, scheduled hours include nightwork and work on weekends and holidays.

According to the limited information available, attendants who are employed in hospitals and similar institutions generally received paid vacations which, after 1 year of service, may be a week or more in length. Paid holidays and sick leave, hospitalization and medical benefits, and pension plans also are available to many hospital employees.

Sources of Additional Information

Information about employment opportunities and duties may be obtained from local hospitals and State and metropolitan health career programs.

Additional information about the work of hospital attendants also may be obtained from:

ANA-NLN Committee on Nursing Careers, American Nurses' Association, 10 Columbus Circle, New York, N.Y. 10019.

Division of Careers and Recruitment, American Hospital Association, 840 North Lake Shore Dr., Chicago, Ill. 60611.

PRIVATE HOUSEHOLD WORKERS

(D.O.T. 301.887; 302.887; 303.138 and .878; 304.887; 305.281; 306.878; 307.878; and 309.138 through .999)

Nature of the Work

Although private household work involves many different jobs, most women employed in this field are maids of various kinds. The *general maid* performs a variety of duties, such as cleaning household furnishings, floors, and lavatories; changing beds; attending children at play; washing dishes; buying, cooking, and serving food; and washing and ironing clothes. The *mother's helper* performs similar duties under her employer's supervision, while learning on the job. More specialized duties are performed by other kinds of maids. For example, the *personal maid* performs personal services for a woman such as keeping her clothes in good condition by mending, cleaning, washing, and pressing them or by having these services performed; cleaning and keeping private quarters tidy; and helping her employer dress. The *nursemaid* cares for children, gives baths, supervises play activities, washes and irons clothes, and prepares meals. When caring for infants, she is called an *infant's nurse* and her duties include sterilizing bottles and other feeding equipment, preparing formulas, and feeding the child at scheduled periods during the day and night. *Babysitters* may perform some or all of the duties of a nursemaid or infant's nurse, but on a daily or an hourly basis.

Housekeepers usually have more responsibility and less supervision than maids. The *home housekeeper* manages a household where there is a large staff of other household employees. She directs their activities, orders food and cleaning supplies, keeps an expenditure record, and may hire and fire employees. The *working housekeeper,* or her rural counterpart, the *farm housekeeper,* often is the only employee in homes where the housewife is absent or is unable to do her own housework. Her household duties combine those of the general maid and the usual responsibilities of a housekeeper. The farm housekeeper also assists in light farm chores, such as feeding chickens, and picking fruits and vegetables for the table.

As their titles suggest, the *cook* and the *laundress* usually handle only one aspect of household work. The laundress washes and irons household laundry, but seldom does other housework. The cook prepares meals. She plans her own menus or follows instructions. She prepares vegetables and meats for cooking, or supervises a *cook's helper* who performs these tasks and other work requiring little skill. The cook also may serve meals and perform special cooking duties such as making preserves and fancy pastries.

A *companion* lives with a convalescent or a person who is alone, and acts as an aide and friend; she generally has the same social background as the employer. A companion attends to the the employer's personal needs and looks after social or business affairs. She may entertain her employer by reading or conversing. A *governess* has charge of children in a home; usually she supervises their recreation, diet, health, and education, according to parents' instructions. Among her duties are teaching music and language, arranging outings, and taking disciplinary measures.

Although women predominate in household work, some jobs are performed by men. The *man-of-all-work,* sometimes called the *handyman* or *odd-job man,* performs a variety of duties to keep a private home clean and in good condition, such as dusting furniture, washing windows, waxing and polishing floors, tending the furnace, repairing screens, painting fences, and caring for the yard. When employed the year-round, he may be called a *caretaker,* and when concerned only with taking care of the house, a *houseman.* The *valet* performs personal services for a male employer, such as brushing, cleaning, ironing, mending, and laying out clothing; mixing and serving drinks; and running errands. The *butler* may supervise household workers, by assigning and coordinating their work; receive and announce guests; answer the telephone; serve food and drinks; or act as a valet. Households not large enough to require both a butler and chauffeur, or butler and houseman, may employ one person who is referred to as *butler-chauffeur,* or *butler-houseman.*

Places of Employment

Over 1.5 million people were employed as private household workers in 1970. These workers are employed in residences throughout the country, but are concentrated in heavily populated urban areas.

Household workers usually spend their working time in their employer's residence. Laundresses, the exception, may work either in their own or their employer's home. Few household workers "live in" their employer's home.

Training, Other Qualifications, and Advancement

For most household workers, there are no formal educational requirements. The ability to cook, sew, wash and iron, clean house, and care for children is generally acquired by girls while helping with the housework in their own homes. This ability also may be acquired by working for about a year as an assistant to an experienced household worker or housewife. Most employers prefer workers who can operate household equipment such as vacuum cleaners, floor waxers, dishwashers, and electric mixers. Home economics courses offered in high schools, vocational schools, and junior colleges as well as training courses sponsored by Federal agencies, State employment service offices, and local welfare departments help to develop domestic service skills beyond the level ordinarily reached in the home.

With knowledge acquired as a mother's helper, a woman can take a job as a general household worker or nursemaid. With this experience or with the skill acquired in a special training program, she can progress to personal maid, infant's nurse, cook, or housekeeper.

For the positions of governess and companion, work experience is less important than educational and cultural background. A companion should be similar to the employer in age, interests, and background. Practical nursing experience is helpful if the employer is feeble or an invalid. A broad educational background in the arts is useful to a governess. Special skills in music, in foreign language, and in teaching young children also are helpful.

Because of the close contact between household workers and members of the families for whom they work, employers look for agreeable and trustworthy workers who are neat, clean, and in good health. Some employers require their household workers, particularly cooks and infant's nurses, to have a health certificate.

Advancement other than a wage increase is generally not available in households with only one or two workers. To get a better job, a domestic worker usually must change to a home where a job requiring greater skill is available.

Employment Outlook

This occupation is characterized by a large number of employment opportunities, but a reluctance on the part of job seekers to do this type of work. In spite of the strong demand for private household workers created by rising family incomes and the added number of wives and mothers working outside the home, the traditionally low pay, long hours, and absence of fringe benefits have attached a social stigma to this work.

In addition to new job opportunities resulting from increased demand for these workers, many thousands of job openings will occur each year as private household workers retire, die, or transfer to other kinds of work.

Earnings and Working Conditions

Wages of household workers vary according to the size of the employer's income, kind of work performed, and local standards of pay. Wages tend to be higher in larger cities, especially in the northern part of the country. Workers who "live in" generally are paid the same wage rates as those who "live out," but get free room and board. Workers who "live out" usually receive a free meal plus the cost of their transportation. According to limited data available, most private household workers earn between $0.90 and $2 an hour.

Private household work involves some hard labor at times, especially for day-workers, who are usually given the heavier tasks in the home. "Live-ins" in homes with no other household workers are likely to be alone most of the time; length and irregularity of working hours often isolate these workers from family and friends.

Dayworkers generally do cleaning on a part-time basis at specific intervals (once or twice a week, or maybe at longer intervals) for part or all of a day. Duties are negotiated with each employer, sometimes on a day-to-day basis. Frequently there is no supervision, as when the employer works away from home during the day and the employee has her own key to the home or apartment.

Most household workers are employed part time. Full-time workers generally work at least 35 hours a week; those who live in usually work longer hours.

Sources of Additional Information

Information about employment opportunities and training programs in private-household work may be obtained from local offices of the State employment service.

Additional information on private household work can be obtained from:

National Committee on Household
Employment, 1725 K Street, NW.,
Washington, D.C. 20036.

BUILDING CUSTODIANS

(D.O.T. 187.168; 381.137, .887;
382.138, .884)

Nature of the Work

Building custodians, often called janitors or cleaners, are responsible for the upkeep and maintenance of hotels, hospitals, office buildings, apartment houses, and other buildings. Their jobs include the responsibility that heating and ventilating equipment function properly, that the building be kept clean and orderly, and that they attend to many other tasks that maintain a building in good condition. On a typical day, a custodian may wet- or dry-mop floors, vacuum carpets, clean furniture and other equipment, make minor repairs, and eradicate insects and rodents.

Custodians use many different tools and cleaning materials. For one job, they may need only a simple mop; for another, they may use an electric polishing machine and a special cleaning compound. In recent years, the maintenance of a building has required less and less physical labor, in part because chemical cleaners and power equipment have reduced the effort needed for cleaning jobs. Custodians must be familiar with cleaning equipment and materials designed for specific tasks, because improper use of a chemical cleaner or machine not only will result in a poor job but may actually harm the surfaces involved, as well.

Most women employed in custodial occupations are assigned tasks such as mopping, dusting, and furniture waxing. Men usually perform the maintenance tasks that require more physical effort; for example, moving furniture, removing refuse cans, and operating floor polishers and buffers.

Some custodians have supervi-

sory positions. Supervisors are responsible for seeing that an entire building or sections of a building are properly cleaned and maintained. They see that certain jobs, such as floor waxing or furniture polishing, are being performed correctly throughout the building.

Places of Employment

About 1.1 million building custodians were employed in 1970; approximately three-quarters were male. They were employed in cities and towns throughout the Nation, and the distribution of jobs was parallel to the population patterns of the United States.

Many building custodians are employed by hospitals and hotels. Large numbers are employed in manufacturing plants and retail stores; many others work in apartment houses and office buildings. Some are employed by contract firms that provide building maintenance service on a fee basis.

Training, Other Qualifications, and Advancement

Most building custodians learn their skills while working on the job. Usually, an inexperienced worker begins by doing simple tasks of cleaning and maintenance. As the worker gains experience with the various cleaners and machines, he is given more complex duties.

There are no formal educational requirements for most positions in custodial work. However, entry workers should be able to do simple arithmetic and follow instructions. Also, high school shop courses may help the building service worker perform the many handymen tasks that are required such as minor plumbing repair or carpentry.

In some cities, training programs where prospective building custodians can learn the necessary skills are provided by unions and government agencies. Students are taught the properties of different surfaces, and the correct way to clean each. They learn to operate and maintain machines such as wet and dry vacuums, buffers, and polishers. Instructions on how to make minor electrical, plumbing, and other repairs also are given. In addition to specific courses that involve custodial tasks, students learn to plan their work and to deal with the public. A few training programs for these workers offer remedial courses in reading, writing, and arithmetic.

Advancement opportunities for custodial workers often are limited because the custodian often is the only maintenance employee in a building. However, where a large maintenance staff is employed, custodians can advance to supervisory positions. For advancement to supervisory positions, a high school diploma is helpful. Some custodians go into business for themselves after becoming thoroughly familiar with their job; they then maintain buildings for clients on a fee basis.

Custodial workers may obtain employment by answering advertisements in the newspapers or by applying directly to a company. Jobs also may be obtained through State employment offices. For government positions, it is necessary to fill out an application for employment and contact civil service or personnel headquarters.

Employment Outlook

Opportunities to enter building custodian jobs are expected to be very favorable through the 1970's. In addition to rapid growth in the number of new jobs that will be created, thousands of job openings will occur each year as experienced custodians retire, die, or transfer to other types of employment.

The employment of building custodians is expected to increase as continued high levels of economic activity, increases in population, and large numbers of young families spur the demand for new apartments, hospitals, offices, recreation centers, and other buildings. However, recent improvements in cleaning and maintenance technology will limit the growth of custodial jobs. Buildings are being designed with surfaces that are specially treated for easy maintenance, and new cleaners and solvents work much more efficiently than those used previously. The growing use of new machines, such as ultrasonic venetian blind cleaners, will reduce the time needed to perform maintenance tasks.

Earnings and Working Conditions

The earnings of building custodial workers vary with the industry in which they are employed. A survey of workers employed in private industry covering 229 metropolitan areas in 1969–70, reports the following average hourly earnings of building custodians:

Average Hourly Earnings

Industry	*Men*	*Women*
Manufacturing	$2.80	$2.57
Public Utilities	2.85	2.38
Wholesale Trade	2.46	2.20
Retail Trade	2.15	1.89
Finance	2.45	2.15
Services	2.14	1.89

Earnings tend to be highest in the large cities of the West Coast and North Central section of the country.

In the Federal Government, building custodial workers pay rates are similar to those paid by private industries in the same local areas.

Most building service workers receive paid vacations and health insurance. Some employers give paid holidays.

Custodians usually work inside heated, well-lighted buildings. However, sometimes they may work outdoors doing tasks such as sweeping walkways, mowing lawns, or shoveling snow. Those primarily concerned with machinery maintenance and building heating systems may find themselves working in noise and grease. Building custodians often suffer from minor cuts, bruises, and burns caused by machines, hand tools, and chemicals.

Custodial workers spend most of their time on their feet. Many of the tasks, such as dusting or sweeping, require constant bending, stooping, and stretching. Some custodial workers work during the evening, because many buildings and offices are cleaned after the regular staff has left for the day. When there is a need for 24-hour maintenance, custodial workers may be assigned to shifts.

Sources of Additional Information

For information about opportunities in custodial work and training programs set up under provisions of the Manpower Development and Training Act of 1962, contact the local office of your State employment service.

SOCIAL SERVICE AIDES

Nature of the Work

Social service or social welfare aides, by freeing the professional social worker for more creative and supervisory responsibilities, enable the social welfare agency to provide more and better service to its clients. Most work under the close guidance and supervision of a social worker or a counselor.

Aides often greet new applicants, help to fill out eligibility forms, and explain the reason information is needed and the way it will be used. Aides also supply applicants with general information about the agency's services, facilties, and procedures. In some welfare agencies, aides gather data necessary to determine an individual's or family's eligibility for public assistance. This work can involve making home visits, interviewing friends and relatives of the applicant, or obtaining necessary documents such as marriage licenses or birth certificates.

Much of the routine paperwork required in most welfare programs has been taken over by welfare aides. They may keep fact sheets on clients up to date, maintain a filing system of reports or a control system for periodic case reviews, and fill out school enrollment, employment, medical, and compensation forms.

Welfare aides also provide escort services, such as guiding the elderly to clinics for medical checkups or driving unemployed clients to job interviews.

Aides usually referred to as *casework aides* or *assistants*, may work directly with clients. They may help clients locate and obtain more adequate housing, counsel parents regarding their children's personal hygiene and dress, or mediate differences between landlords and tenants.

Apart from these more specific duties, the single most useful function of the aide is to be a friendly listener—to be available when needed to offer encouragement and counsel.

Homemaker aides are assigned to a home for 1 or more days a week or instruct a group of housewives at a community center. They help

women improve their skills in shopping, cleaning, sewing, budgeting, family health and hygiene, child care, and meal planning and preparation.

An important facet of the homemaker aides' work is the actual demonstration of homemaker skills. Stressing the importance of regularity and routine in the home, they set up a schedule of weekly activities. Then they get down to particulars of housekeeping by teaching homemakers how to clean a stove or refrigerator, how to prepare a meal from leftovers, or how to recognize a bargain in inexpensive material and make an attractive dress. They encourage clients to take advantage of all cost-saving opportunities—the barber school for inexpensive haircuts, the thrift shop, surplus foods, and free recreation.

In addition to instructing in domestic skills, some homemaker aides help housewives develop social skills by going with the homemaker to the clinic to act as an interpreter and to lend moral support or help communicate effectively with institutions that provide valuable services—the schools, the welfare department, or a Community Action Agency. *Outreach workers* serve as a bridge between community agencies and the people being served, to maintain a two-way flow of information.

Neighborhood workers are one type of outreach worker. Functioning through a Community Action Agency, they personally contact the residents of an area to explain and discuss the services of the agency. They determine the needs of individuals and families and refer routine cases to a counselor or to the appropriate community service agency. The more difficult problems are reported to a supervisor. Neighborhood workers may inform residents about employment opportunities, availability of housing, manpower training opportunities, and public services. On a broader scale, they assist in the organization of block clubs and other neighborhood groups designed to conduct programs to benefit the neighborhood, to foster a sense of community responsibility among residents, and to encourage participation in the antipoverty efforts of the community action agency. They may assist in routine neighborhood surveys and counts, keep records, and prepare reports of their activities for the supervisor.

Employment aides, another type of outreach worker, assist in actively seeking out the disadvantaged and preparing them for employment through special training and counseling. Stationed in neighborhood centers or working in mobile units, they locate candidates for available jobs and training programs by contacting residents at various locations throughout the neighborhood—poolrooms, laundromats, and street corners. Then, they provide the unemployed with initial information about the services of the local State Employment Service office and the requirements for a particular position, and help them fill out the necessary application forms. After the workers are employed, aides maintain contact with their clients to help them adjust to the new work environment and to iron out minor difficulties.

Places of Employment

An estimated 50,000 social service aides were employed in the United States in 1970. Most are concentrated in large cities, especially in "poverty pockets." About 3,400 employment aides were employed in State Employment Service offices.

Training, Other Qualifications, and Advancement

Graduation from high school is not generally a requirement for social service aides. Aides usually are trained on the job from one to several months; in addition, nongraduates often have classroom instruction to help them pass a high school equivalency examination. Employers of social service aides do not always look for the most highly skilled applicants. A person's need for work, as well as his potential for upgrading his skills and making a useful contribution to the agency, is weighed in evaluating prospective applicants.

Apart from formal requirements, aides need to get along well with people, especially the disadvantaged. It is important that they be tactful and courteous and possess strong leadership qualities.

Homemaker aides should be housewives and mothers who have demonstrated competence in running homes and rearing children. Neighborhood workers assigned to a Puerto Rican or Mexican-American community should be able to understand and speak Spanish. Typing ability is required for some welfare service aide positions.

Most social service programs emphasize the development of career ladders with opportunities for advancement through a combination of work experience and further education. Entry level jobs as employment aides can lead to positions as employment agents and coaches, then to employment interviewers, and, finally, after special training, to employment counselors. Employing agencies frequently are willing to pay part of the cost of further education for their social service aides.

Employment Outlook

A large proportion of aide jobs in the social services have been generated by antipoverty legislation. The Economic Opportunity Act of 1964 created opportunities for neighborhood workers through Community Action programs. The 1967 Amendments to the Social Security Act authorized the employment of supportive staff in welfare programs. And finally, the 1966 Scheuer Amendment to the Economic Opportunity Act is expected to open up a wide variety of social service jobs for unemployed and low-income persons. This amendment established the New Careers program, which is designed to create entry level positions in public service, including health, education, welfare, neighborhood redevelopment, public safety, and recreation. Its objectives are to provide permanent positions within service agencies and to encourage employer responsibility for providing aides with the training and education necessary to move up an established career ladder. The promise of a job upon successful completion of training and the opportunity to move up to higher level positions set the New Careers program apart from most other federally sponsored training programs.

Earnings and Working Conditions

The starting salary of social welfare aides graduating from the New Careers program was about $2.25 per hour in 1970. Employment aides started at about $4,200 per year.

In the Federal Government in 1970, beginning social work aides (welfare aides) earned from $4,125 to $5,212 per year. Experienced workers earned from $5,853 to $7,294 per year.

Many aides work fewer than 40 hours a week.

Sources of Additional Information

Information on requirements for positions as social service aides may be obtained from the city, county, or State department of welfare, department of recreation, or local Community Action Agency. Information on employment aide positions is available from the State civil service or merit system office in each State capital or from local offices of the State Employment Service.

MODELS

(D.O.T. 297.868 and 961.868)

Nature of the Work

Models convey the idea that life can become happier, more glamorous, adventuresome, or secure if people buy the products or use the services they advertise. The attractive female model or the athletic male model furnishes the indispensable image that can trigger public demand for a new look or product.

Most models specialize in some line of fashion or photographic work.

Fashion models wear clothing gracefully and exhibit an air of distinction. As they walk, pivot, and turn to the back and side, they reveal the highlights of each garment for prospective buyers. On some jobs, they may stop before a prospective purchaser to mention the price and the style number of the garment. Fashion models employed by apparel designers, manufacturers, and wholesalers are called showroom or wholesale models. At peak seasons, showroom models are on duty constantly. During slack periods, when the showroom is empty for many hours each day, they may perform various clerical jobs.

Fashion models employed in department stores, custom salons, and other retail and specialty shops are called informal models. This type of modeling is for customers or promotional purposes and usually conducted at a more leisurely pace than in showrooms.

In the other major branch of modeling—photographic—the work generally is done for advertising or editorial purposes. Photographic models are employed by advertising agencies or free-lance photographers who supply pictures for cata-

logs, pamphlets, and magazine and newspaper ads or features. Photographic models should have some acting ability, since facial expressions help to create the desired mood. To show pleasure, dissatisfaction, or surprise under bright lights in a hard-to-hold pose is not easy.

Photographic models usually work in a neighborhood photographer's studio; occasionally they fly to places such as Miami Beach or Paris to pose against an authentic background.

In addition to fashion or photographic work, models demonstrate new products and services at manufacturers' exhibits and industry trade shows, in commercial or fashion films, or on television. Some are hired by designers for fittings; still others pose for artists and sculptors.

Places of Employment

An estimated 55,000 models were employed in the United States in 1970. Many worked part time; approximately 4 out of 5 were women or girls. Although most models are employed in major cities, the largest number work in New York City, center of the fashion industry. Large numbers also are employed in Chicago, Dallas, Detroit, Los Angeles, Miami, San Francisco, and Washington, D.C.

Manufacturers, designers, and wholesalers employ the largest number of full-time models. In New York City's garment district, for example, thousands of firms and designers permanently employ from one to four models. Others work for advertising agencies, retail stores, mail-order houses, and magazines, as well as for commercial artists, sculptors, illustrators, fashion artists, and art schools.

Training, Other Qualifications, and Advancement

Employers prefer to hire models who have training or experience. Prospective models should attend a modeling school to learn the proper way to walk and stand, how to style hair and use makeup, and to select the appropriate clothing and accessories. In photo modeling courses, students are taught to pose for the photographer and convey different emotions through facial expressions. Classes in developing personality and poise are helpful.

Placement offices at modeling schools provide jobs for many students. Some jobseekers find employment by registering at a model agency. The agency usually asks the applicant for photos in a number of modeling poses to show prospective clients. Department stores sometimes hold auditions that give inexperienced models an opportunity to display the newest styles. Some part-time jobs in department stores also provide useful experience in handling clothing, observing customers, and occasional modeling. Sometimes experience can be gained in local fashion shows to raise funds for charity.

Although no formal educational requirements are necessary for many jobs, some employers require a high school diploma; a few prefer some college. Courses in art, speech, drama, dancing, fashion design and salesmanship are useful. The job demands not only perfect grooming, poise, and a pleasant personality, but also physical stamina and a generous helping of determination. Models are required to withstand the pressures of close schedules and quick changes. Sometimes they work under uncomfortable conditions, such as modeling furs in the summer or swim suits in winter. The wise aspirant will take typing, shorthand, or other practical courses as income insurance between modeling assignments.

Young fashion models must be well proportioned and slim, since they usually model manufacturers' samples in small sizes. Many models, however, work for manufacturers who specialize in apparel for particular types of individuals, such as sportsmen, toddlers, the short, the tall, or the stout. A female shoe model generally must wear size 5, and a hosiery model must have very long and graceful legs. The male model should be able to wear trim clothing—usually a size 40 or 41 long suit. In short, a fashion model is hired to fit the clothing.

Not all attractive people have physical characteristics acceptable for commercial photography. Women photographic models, for instance, usually must be long-waisted and at least 5 feet 6 inches tall, have good teeth, and a face that is pretty or reflects the style demand of the period.

Modeling can serve as a steppingstone to other jobs in the fashion field such as fashion coordinator, staff editor of a fashion magazine, or fashion consultant. Models who serve as doubles or stand-ins in movies or television may become actors or actresses. Some work their way through art school by modeling and then qualify for jobs as fashion illustrators.

Employment Outlook

Full-time modeling should remain highly competitive through the 1970's. Because young people are attracted to the glamour attached to this occupation, the number of job hunters is expected to be much larger than the number of full-time jobs. Employment opportunities for part-time work, however, should be favorable.

Employment of models is expected to increase moderately through the 1970's. Expanded employment is anticipated in industries such as apparel manufacturing, wholesale and retail trade, and advertising. The competition to gain a greater share of growing sales volume will increase emphasis on product promotion and, in turn, stimulate the demand for models.

Most openings for models will result from the need to replace those who leave the field. The work span of most models is relatively short —particularly in high fashion modeling where the accent is on youth. Others are eased out of the field because the work with which they are identified becomes outdated or their pictures have been seen too often. Many women also leave modeling to marry and raise a family. For these reasons, female models seldom work more than 8 years. The working life of the male model, on the other hand, generally is much longer—often 20 years or more.

Earnings and Working Conditions

A model's earnings depend on factors such as the type and place of employment and the nature, frequency, and duration of assignments. Although the earnings of a few top models are high and range to $40,000 or more a year, most models earn much less. According to the limited information available, beginning fashion models who worked full time for manufacturers or wholesalers generally earned from $95 to $100 a week in 1970. Those having experience had weekly earnings of $100 to $135. Beginning models employed by retail stores usually were paid from $65 to $100 a week, whereas experienced retail models earned from $110 to $125. Retail models often supplement their weekly salaries by modeling in fashion shows. A model is paid for pre-show fittings as well as the show at hourly rates ranging from $15 in some cities to $60 for experienced models in the New York City area.

Beginning photographic models earned from $25 to $50 an hour in 1970. This rate is deceptive when considered on a weekly or annual basis because many models—especially beginners—work only a few hours each week. Although photographic modeling often pays well, it can be an "expensive" career. In many cases, models must provide their own accessories and pay for other expenses. Occasionally, a complete outfit is needed to get a job.

Television models earn at least $35 an appearance as an extra, and at least $135 an appearance as a principal character, plus an additional amount for each rerun. They must be members of a union—either the Screen Actors Guild, Inc., or the American Federation of Television and Radio Artists.

Manufacturers, wholesalers, and retailers usually employ models on a permanent basis. They work a 5-day week and receive a 2-week vacation and other benefits. Those who work through agencies or on a free-lance basis, however, receive no supplementary benefits. Models usually are paid time and a half for work after 5:30 p.m. on weekdays, and for any time worked on Saturdays and Sundays. The client pays travel expenses outside the city. Additional compensation also is received for hazardous assignments, such as striking a friendly pose with a lion or climbing a ship's rigging.

Modeling may influence the model's personal life. Since the camera highlights the effects of keeping late night hours, for example, a model may limit evening social engagements to be fresh for the next day's work. In addition, a female model must devote part of each evening to beauty care, and sometimes must prepare clothing and accessories for the next day's assignment. To stay in the profession, the high fashion model must remain very slender.

Sources of Additional Information

Young people interested in attending a professional modeling or charm school can write to the Department of Education in their State for a list of approved modeling schools.

Catalogs describing the program, entrance requirements, and tuition costs at particular modeling schools may be obtained by writing their directors.

SKILLED AND OTHER MANUAL OCCUPATIONS

The 27.8 million blue-collar workers—skilled, semiskilled, and unskilled—employed in 1970 made up more than one-third of all the Nation's employed workers. They work in hundreds of different occupations and perform many important functions in our economy. They transform the ideas of scientists and the plans of engineers into goods and services. They operate transportation and communication systems that tie the country together. They build homes, office buildings, and factories. They fabricate, install, control, maintain, and repair the complex equipment necessary for operating our highly mechanized society. They repair automobiles, television sets, washing machines, and other household appliances. They move raw materials, wrap and pack finished products, and load and unload supplies and equipment of all kinds.

Young persons who have mechanical interests and abilities, or who enjoy working with their hands, will find many employment opportunities among the hundreds of occupations in this group.

Technological progress is causing major changes in the occupational composition of the Nation's labor force. Rapid advances in the industrial applications of scientific knowledge and invention are making possible increasing use of automatic devices that operate the machinery and equipment used in manufacturing. Nonetheless, the number of skilled and semiskilled workers is expected to continue to increase through the 1970's, despite this rapid mechanization and automation of production processes. It is expected that our increasingly complex technology generally will require higher levels of skill to operate and service this machinery and related equipment.

Although blue-collar workers declined slightly as a proportion of total employment between 1960 and 1970, their number increased by about 3.7 million. Semiskilled workers accounted for nearly 53 percent of the increase, skilled workers for 43 percent, and unskilled workers for less than 5 percent.

Through the 1970's, employment of blue-collar workers is expected to increase only about half as fast as total employment. However, different rates of growth are expected for each of the three major occupational groups that make up the blue-collar worker category. For example, employment of skilled workers is likely to increase nearly as fast as total employment; semiskilled workers will grow at a much slower rate; and no significant change is expected in the number of unskilled workers.

In addition to the large number of job opportunities expected to be available for blue-collar workers because of employment growth, an even greater number is expected to result from the replacement of experienced workers who retire, die, or transfer to other fields of work. Replacement needs caused by retirements and deaths alone should provide more than 600,000 job openings annually. For skilled workers, replacement needs are expected to offer about the same number of job opportunities as employment growth. For semiskilled workers, on the other hand, replacement needs are expected to offer more than twice as many job opportunities as employment growth. For unskilled workers, virtually all job opportunities will come from replacement needs.

The skilled, semiskilled, and unskilled occupation groups are discussed separately in the following section. Following these general discussions are more detailed statements on selected blue-collar occupations. Many other blue-collar occupations also are described in individual industry statements elsewhere in the *Handbook*.

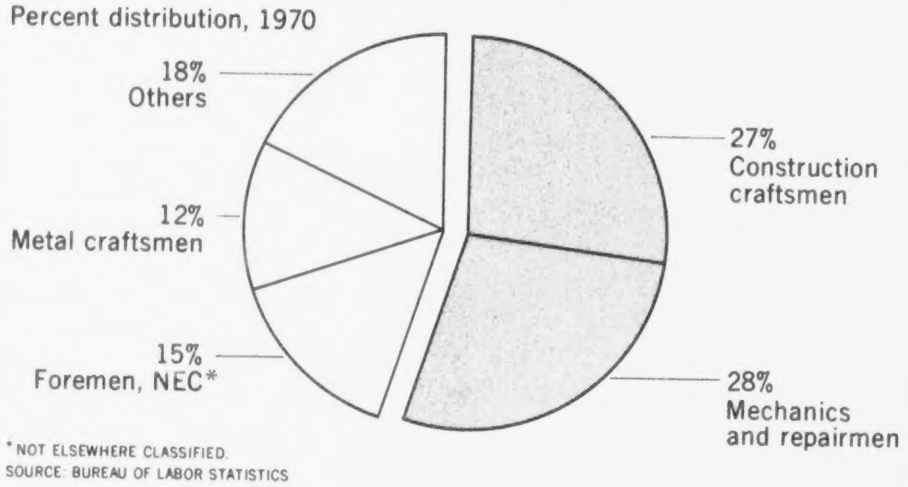
SKILLED WORKERS

(Craftsmen, Foremen, and Kindred Workers)

The Nation's economic strength depends to a great extent on the initiative and competence of its skilled work force. Skilled workers make the patterns, models, tools, dies, machines, and equipment without which industrial processes could not take place. They repair the equipment used in industry, and the mechanical equipment and appliances used by consumers. They also build homes, commercial and industrial buildings, and highways.

In 1970, there were about 10.2 million skilled workers. More than half of them were employed in two broad occupational groupings—construction craftsmen and mechan-

㉒ **More than 10 million workers are employed as craftsmen and foremen**



* NOT ELSEWHERE CLASSIFIED.
SOURCE: BUREAU OF LABOR STATISTICS

ics and repairmen. (See chart 22.) Two occupations had more than 800,000 workers each—carpenters and automotive mechanics. About a dozen additional skilled occupations had more than 100,000 workers each. (See chart 23.) However, many skilled occupations, such as watch repairmen and paperhangers, had fewer than 20,000 workers each.

Although skilled workers are employed in almost every branch of industry, more than three-fifths work in manufacturing and construction. About 9 out of every 10 skilled workers are employed by private firms; others are self-employed or work for Federal, State, or local governments. The building trades have a fairly high percentage of self-employed craftsmen. As might be expected, the skilled work force is concentrated in the highly populated and industrialized States. Job opportunities, however, are found in every State. A very small proportion (about 3 percent) of skilled workers are women.

Training, Other Qualifications, and Advancement

Skilled workers must have a thorough knowledge of the processes involved in their work. They often exercise independent judgment and they may also be responsible for valuable equipment or products. Consequently, they require considerable training to qualify for their jobs. A large proportion of skilled workers learn their trades through informal on-the-job training and experience. Many others learn their trades through apprenticeship or other formal training programs. Large numbers of young men also acquire skills in the armed services. For others, vocational school training plays an important role.

Most training authorities agree that the best way to learn a skilled trade is through a formal apprenticeship program. Apprenticeship is a period of systematic on-the-job training, supplemented by related trade instruction, which is designed to familiarize the apprentice with the materials, tools, and principles of the trade. The apprenticeship program provides the trainee with a balanced knowledge of his trade. The formal apprenticeship agreement specifies the training time the apprentice is to receive in the various aspects of the trade. Most apprenticeship programs last from 3 to 4 years.

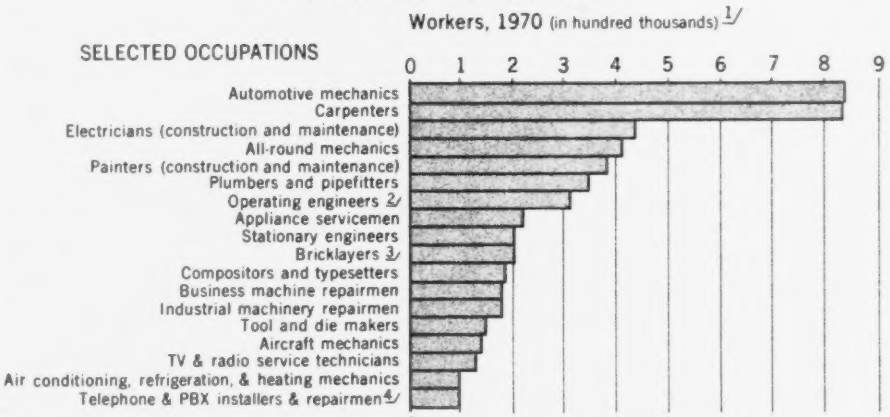
Apprenticeship has several advantages over less formal methods of learning a trade. An apprentice receives broad training and experience that enable him to adjust to constantly changing job requirements, and prepare him to work in a wide range of jobs. The completion of an apprenticeship also gives the worker a recognized status that is an advantage in finding and holding jobs. In addition, it may increase his opportunities for promotion to a foreman or supervisory-level job.

Many companies have training programs that also provide systematic on-the-job training. Frequently, these programs include supplementary classroom instruction.

Many young persons move from one semiskilled job to another and, over a period of years, acquire knowledge and skills sufficient to make them skilled workers. Others begin learning a skilled trade in vocational, trade, or technical schools. A small proportion of these students move directly into jobs in their trade and, after acquiring on-the-job experience, qualify as skilled workers. Other young persons, who already are employed in semiskilled or unskilled jobs, move into skilled occupations by taking vocational studies related to their work, such as correspondence courses, manufacturers' training programs, and night school courses.

Large numbers of young men acquire skills in the Armed Forces that enable them to qualify, with additional training, for skilled jobs in civilian life, such as automobile

(23) Many skilled occupations have more than a hundred thousand workers



1/ ESTIMATED
2/ EXCAVATING, GRADING, AND ROAD MACHINERY OPERATORS
3/ INCLUDING TILE SETTERS, STONEMASONS, AND MARBLE SETTERS
4/ INCLUDING CENTRAL OFFICE CRAFTSMEN

SOURCE: BUREAU OF LABOR STATISTICS

mechanic, aircraft mechanic, electrician, or office machine repairman.

Many supervisors and men in administrative positions have come from the ranks of craftsmen. Employers long have recognized the value of executives who have both industrial know-how and administrative ability.

Young persons who do not expect to go to college should consider the definite advantages the skilled trades offer, compared with semiskilled and unskilled occupations. Skilled workers have higher earnings, more job security, better chances for promotions, and more opportunities to open their own businesses than most workers having lesser skills. Among the 11 occupational groups that make up our labor force, only men in the professional, managerial, and salesworker groups had higher earnings than the average $8,791 a year earned by skilled men in 1969.

Employment Trends and Outlook

Employment in skilled occupations grew from about 8.6 million workers in 1960 to 10.2 million in 1970. Continued growth in the number of skilled jobs is expected in the years ahead. Job opportunities also will result from the replacement of skilled workers who transfer to other fields of work, are promoted, retire, or die. About 215,000 skilled workers are expected to be needed each year to replace those who retire or die.

Employment in skilled occupations is expected to rise moderately through the 1970's because of industrial growth and technological advances that increase the need for skilled workers. As in the past, rates of employment growth will differ among the skilled occupational groups. For example, employment of mechanics and repairmen and construction craftsmen is expected to grow more rapidly than the skilled work force as a whole, and employment in major skilled machining occupations is expected to grow less rapidly. On the other hand, employment in the printing trades is expected to show little or no change.

Young men who acquire a good basic education (including courses in mathematics and the sciences), as well as thorough job training, will be better able to compete for higher paying skilled jobs than applicants without this training.

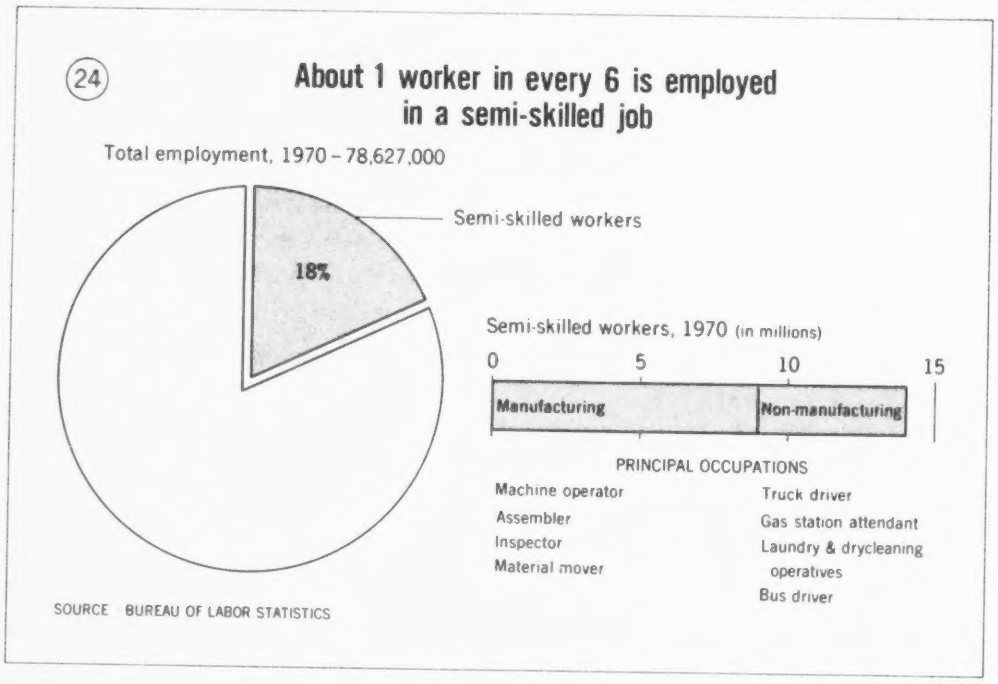
SEMISKILLED WORKERS

(Operatives)

Semiskilled workers make up the largest occupational group in the Nation's labor force. About 13.9 million workers—1 out of every 6—were employed in semiskilled jobs in 1970. Of the 9 million semiskilled workers employed in manufacturing industries (chart 24), large numbers were engaged in processing food, making textiles and clothing, and producing automobiles and industrial machinery. The broad field of semiskilled jobs will provide hundreds of thousands of employment opportunities for young persons in the years ahead.

Truckdrivers account for the largest single group of semiskilled workers. Millions of other semiskilled workers operate power driven machines in factories. Many use sewing machines to join fabrics for clothing. Others operate machines to stamp out metal parts; still others use machine tools, such as engine lathes and milling machines, to shape metal to precise sizes. A considerable number of semiskilled workers operate materials moving equipment, such as forklift trucks, to move raw materials and manufactured products from place to place in factories.

Large numbers of semiskilled workers are employed as assemblers and inspectors. Assemblers install



㉔ About 1 worker in every 6 is employed in a semi-skilled job

SOURCE BUREAU OF LABOR STATISTICS

components and subassemblies into end products such as radios and television sets. Inspectors examine and test products to find out whether their quality is satisfactory. Many semiskilled workers in factories are employed as helpers or assistants to skilled workers. For example, stationary firemen help skilled stationary engineers operate and maintain steam boilers.

In 1970, 4.3 million women accounted for about 30 percent of all semiskilled workers. Jobs like those of sewing machine operators, packers and wrappers, and assemblers were by far the largest source of employment for women in manufacturing. The number of women employed in the different manufacturing industries varied considerably. Women accounted for a large proportion of the semiskilled jobs in the apparel, textiles, and food industries. On the other hand, plants that produce iron and steel and petroleum products employed relatively few women in semiskilled jobs.

Training, Other Qualifications, and Advancement

Semiskilled workers ordinarily receive only brief on-the-job training. Usually, they are told exactly what to do and how to do it, and their work is supervised closely. They often repeat the same motions or the same routine throughout the working day.

Semiskilled workers do not need to invest many years in learning their jobs. The simplest, most repetitive jobs can be learned in a day and mastered in a few weeks. Even jobs that require a higher degree of skill, such as truckdriving, can be learned in a few months. At the same time, the ability to learn new jobs quickly, including the operation of new machines, is an important qualification for semiskilled workers.

New employees in semiskilled jobs are not expected to be highly proficient. After a short training period, however, they must work at a fast and steady pace. Frequently good eyesight and good coordination are required.

Semiskilled jobs often pay well. Some semiskilled workers who are paid on an incentive basis are among the highest paid workers in manufacturing. However, the average annual earnings of semiskilled men in 1969 was $7,348—$1,443 less than those of skilled men. An added disadvantage is that semiskilled workers are more likely to lose their jobs during a business recession, and to remain unemployed longer than skilled or white-collar employees.

Employment Outlook

Employment of semiskilled workers is expected to increase slowly through the 1970's. Most job opportunities are expected to result from the need to replace workers who are promoted, transfer out of semiskilled jobs, retire, or die. About 320,000 job openings are expected each year as a result of retirements and deaths. Transfer rates for semiskilled workers are high because a large proportion of them are young workers who tend to change jobs frequently, and women workers who leave their jobs to marry, raise families, or move to other areas when their husbands change jobs.

The continuing growth in the use of commercial motor vehicles will increase employment opportunities for drivers of trucks and buses. Greater substitution of power equipment for unskilled labor in lifting, hauling, digging, and similar heavy physical work will create new jobs for semiskilled workers such as power equipment operators. On the other hand, employment growth in manufacturing will be limited by increasing automation of production processes. There are many processes, however, to which automation is not likely to be applied in the

1970's, and many industries in which the impact of automation will be limited.

Young men and women who have no training beyond high school will continue to find a major area of job opportunities in semiskilled occupations. The most rapid gains in the Nation's employment, however, will be in professional, technical and other white-collar occupations and in skilled occupations. If possible, young persons having ability should obtain the additional training and education that these occupations require. Semiskilled workers, however, even those who did not complete high school, are not cut off permanently from advancement if they take advantage of the many educational opportunities available in their communities. They may take courses in evening schools or enter apprentice training programs and eventually qualify for better jobs.

UNSKILLED WORKERS

(Laborers)

Unskilled laborers work in manual occupations that generally require no special training. These jobs usually involve handling and moving materials; for example, loading or unloading, digging, hauling, hoisting, wrapping, and mixing. Some jobs require heavy physical work. About half of the 3.7 million unskilled laborers employed in 1970 worked in manufacturing and construction industries. A large proportion of the remainder were employed in retail and wholesale trade, transportation, public utilities, and service industries.

Although some of these jobs pay well, particularly in construction work, the average annual earnings of unskilled men in 1969 was $6,082—$1,266 less than those of semiskilled men. Moreover, unskilled workers are usually the first to lose their jobs during a business recession; they have the highest unemployment rate of all the major occupational groups.

Little or no change in the number of unskilled laborers is expected through the 1970's. Nevertheless, there will be thousands of opportunities for new workers to get jobs as unskilled laborers because of the need to replace workers who transfer to other fields of work, retire, or die. Deaths and retirements alone are expected to result in about 70,000 job openings each year.

Mechanical equipment has been replacing manual labor, and this trend will continue. Power-driven equipment, such as forklift trucks, derricks, cranes, hoists, and conveyor belts will take over more and more materials-handling work in factories, freight terminals, and warehouses. Other power-driven machines will do excavating, ditch-digging, and similar work. Integrated systems of processing and materials-handling equipment, a more advanced step in automation, will be installed in an increasing number of plants in the years ahead. Industrial expansion, however, is expected to create a need for unskilled laborers which will approximately offset the jobs lost to laborsaving mechanical equipment.

FOREMEN

Nature of the Work

Foremen play a strategic role in the economic activities of the Nation. They supervise and coordinate the work of highly skilled, semiskilled and unskilled blue-collar workers, and are often responsible for millions of dollars worth of equipment and material. They may oversee workers engaged in assembling television sets, servicing automobiles, laying bricks, unloading ships, or any thousands of other activities. Foremen often are referred to by different titles. For example, in the textile industry they are referred to as second hands; on board ship they are called boatswains; and in construction they are known by titles such as overseer, strawboss, gang leader, or pusher.

Supervising workers is the most important part of the formen's job. Many blue-collar workers never work under supervisors above the rank of foreman, and it is through their foremen that they get their work orders, their discipline, and their recognition. Foremen interpret and communicate company policy to the workers. They are responsible for the guidance and instruction necessary to assure that workers are qualified to handle their assignments and to see that new employees are properly trained for their jobs.

In some enterprises, foremen, in addition to their supervisory responsibilities, work at specific crafts. "Working foremen" are common in construction, where, for example, bricklayer foremen supervise the work of journeymen bricklayers and helpers and also lay brick. Working foremen in some cases belong to the same labor union as the workers they supervise.

Foremen must plan and schedule the work of their subordinates and maintain production and employee records. They spend part of their time participating in meetings and preparing reports on production, cost, personnel, and safety. Foremen must exercise considerable judgment in their planning and allow for unforeseen contingencies such as absenteeism and machinery breakdown.

Foremen see that safety rules and regulations are observed and instruct employees in safety practices. In unionized plants, foremen may meet with union representatives to discuss work problems and grievances. They must know the provisions of labor-management agreements and run their operation according to the agreements.

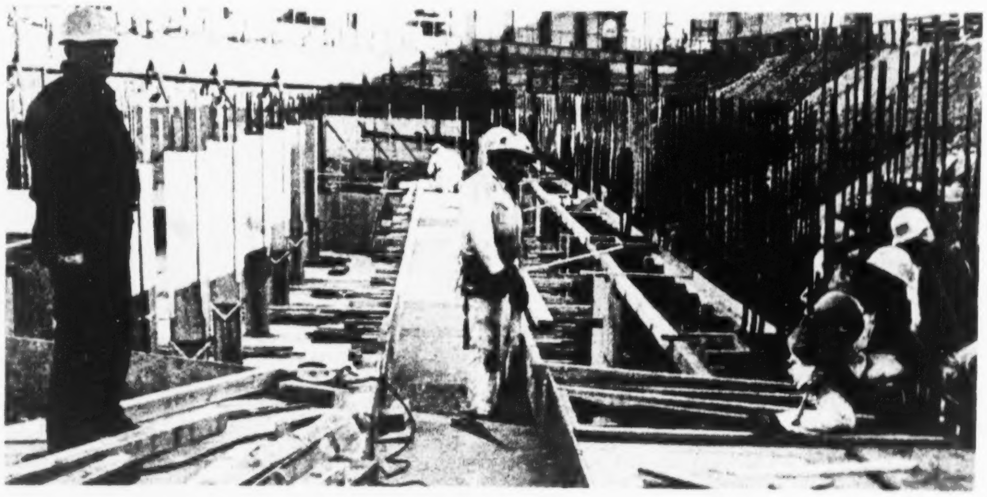
Places of Employment

Almost every business enterprise and government agency that employs blue-collar workers has foremen. Nearly 1.5 million were employed in 1970; about 90 percent were men.

Foremen work mainly in the highly industrialized sections of the Nation. About three-fifths are employed in the following manufacturing industries: machinery, metals, transportation equipment, food, chemicals, and paper products. Large numbers also are found in the construction, trade, and service industries. Female foremen, or foreladies, are primarily employed in the apparel, electrical machinery, leather products, and laundry and drycleaning industries.

Training, Other Qualifications, and Advancement

Unlike entry requirements for most supervisory positions, employers generally look for experience and skill rather than specific educational background when choosing foremen. Most foremen rise through the ranks—that is, they are promoted from the machine or work bench or construction craft. By performing different jobs over a period of time, they develop their skills and acquire a thorough knowledge of the processes involved in the work they supervise. During this time, they also learn much about their fellow worker, individually and collectively, and about management policies and employee attitudes toward these policies. Very



often, foremen are former union members who have served as elected representatives and learned about grievance procedures, collective bargaining, and labor management contracts.

The experience gained by foremen rising through the ranks gives them the advantage of knowing how a job should be done and possible problems involved, and helps them know what to expect from the workers they supervise.

Most workers who are promoted to foremen jobs are high school graduates who have learned their skills on-the-job. Many have acquired technical skills through apprenticeship or other formal training programs, and some have benefited from courses offered through Armed Forces training schools. Although fewer than one-tenth of all foremen are college graduates, a growing number of employers are hiring foremen trainees with college backgrounds. This practice is most prevalent in industries that have highly technical production processes such as the chemical, oil and electronics industries. Employers generally look for college graduates with backgrounds in business administration, industrial relations, mathematics, engineering, or science. These workers are hired as foremen helpers and undergo on-the-job training until they are capable of accepting supervisory responsibilities.

Employers look for leadership qualities when considering persons for foremen positions. Especially helpful is the ability to motivate employees, command respect, and get along with people.

Foremen with outstanding ability, particularly those with post-high school education, may move up to higher management positions. In manufacturing, for example, foremen may advance to jobs such as department head, general foremen, and plant manager. In the construction industry, some foremen use the experience and skills they acquire to go into business for themselves.

Employment Outlook

Employment of foremen is expected to increase moderately through the 1970's. In addition to the substantial number of job opportunities expected to occur as a result of employment growth, an even greater number of job openings will occur each year as experienced foremen are promoted, transfer to other occupations, retire, or die.

Factors underlying the expected growth of foremen are the increase in the size of business operations and government services requiring blue-collar workers, and the growing trend towards increased supervision as industrial production processes become more technical. More foremen, for example, will be required for functions such as inspection and production scheduling.

Most foremen will continue to be employed in manufacturing. However, more than half of the increase in the number of foremen during the 1970's will be due to the rapid expansion of nonmanufacturing industries—construction, trade, service, and public utilities. The number of foremen in construction is expected to grow very rapidly.

Earnings and Working Conditions

Salary levels of foremen generally are keyed to the earnings of the highest paid workers they supervise. Some companies have a formal policy to maintain specific wage differentials between foremen and the workers they supervise that range from about 10 percent to 40 percent. However, these differentials do not take into account overtime payments to hourly workers. Foremen are usually salaried and not paid for overtime. If they are paid for overtime, they normally do not get the premium rate that workers under their supervision receive. In 1969, the average (median) earnings of foremen who worked full time during the year was $9,493.

Working conditions of foremen vary widely from industry to industry. As the lowest level supervisory group, foremen spend much of their time with the workers on the plant floor or at the construction site. Plant foremen are apt to get dirty around machinery and materials and may be subjected to noisy manufacturing operations. Construction foremen often are subject to unpleasant weather conditions. Foremen generally work more than 40 hours a week and often are expected to be at work before their subordinates arrive, and remain there after they leave.

Some foremen who have limited authority may feel isolated, neither a member of the workforce nor a significant part of management. On the other hand, the foreman position holds more prestige than that of blue-collar workers and the work is often more challenging and rewarding.

Sources of Additional Information

American Management Association, 135 West 50th St., New York, N.Y. 10020.

BUILDING TRADES

Building trades craftsmen represent the largest group of skilled workers in the Nation's labor force. Altogether, there were more than 2¾ million of these craftsmen employed in 1970—about 3 out of every 10 skilled workers.

The more than two dozen skilled building trades vary greatly in size. Several major trades—carpenter, painter, plumber, pipefitter, bricklayer, operating engineer (construction machinery operator), and construction electrician—each had more than a hundred thousand workers. (See chart 25.) Carpenters alone numbered 830,000—nearly one-third of all building craftsmen. By contrast, only a few thousand were employed in each of several trades such as marble setter, terrazzo worker, glazier, and stonemason.

What Are the Building Trades?

Building trades craftsmen are employed mainly in the construction, maintenance, repair, and alteration of various structures. These include homes and other types of buildings, highways, and airports. They also include substantial work in the Nation's defense and space programs.

The wide range of materials and skills used in construction has resulted in the specialization of various work operations. Thus, building trades workers who use essentially the same materials or skills have tended to become identified with distinct trades. For example, bricklayers and stonemasons both work with masonry materials. Although operating engineers do not work with particular materials, they have a group of related skills that enables them to handle various types of excavating, grading, hoisting, and other equipment.

The building trades consist primarily of journeymen (craftsmen) who generally must have a high level of skill and a sound knowledge of assembly and construction operations. They often are assisted by apprentices, tenders, and laborers.

The work of journeymen may be grouped into three broad classifications—structural, finishing, and mechanical. However, some craftsmen—for example, carpenters—may do finishing as well as structural work. Generally, each building trade is classified in one of these three categories, as follows:

Occupations mainly concerned with structural work: Carpenter, operating engineer (construction machinery operator), bricklayer, structural-iron worker, ornamental-iron worker, cement mason, reinforcing-iron worker (rodman), rigger and machine mover, stonemason, and boilermaker.

Occupations mainly concerned with finishing work: Lather, plasterer, marble setter, tile setter, terrazzo worker, painter, paperhanger, glazier, roofer, floor covering installer, and asbestos worker.

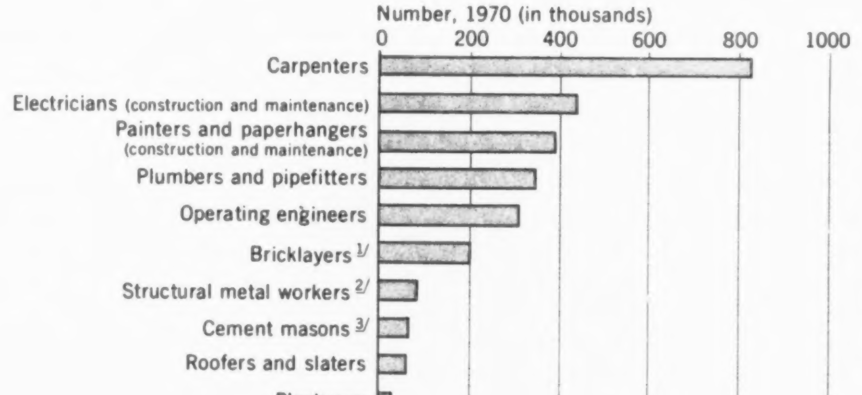
Occupations mainly concerned with mechanical work: Plumber, pipefitter, construction electrician, sheet-metal worker, elevator constructor, and millwright.

Most building trades occupations are described individually later in this chapter. These descriptions are necessarily brief and incomplete. They do not apply fully to all localities because of local differences in the types of work done by the various trades.

Also, they are not statements or recommendations concerning the work jurisdiction of these trades and are inappropriate for use in jurisdictional negotiations or the settlement of jurisdictional questions.

Detailed descriptions of the nature of the work, training, employment outlook, and other information concerning boilermakers and millwrights appear elsewhere in the *Handbook*.

(25) **Employment in the building trades**



1/INCLUDES STONEMASONS, MARBLE SETTERS, AND TILE SETTERS
2/STRUCTURAL AND ORNAMENTAL IRON WORKERS
SOURCE: BUREAU OF LABOR STATISTICS
3/ INCLUDES TERRAZZO WORKERS

Where Building Trades Workers Are Employed

Building trades workers are employed mainly by contractors in the contract construction industry. Many others are employed in industries other than construction, mainly to do maintenance and repair work. Some work directly for business firms or government agencies that have their own construction force, and others are self-employed.

The building trades craftsmen who work in the contract construction industry are employed by general and special-trade contractors. General contractors may be classified as building (residential, commercial, or industrial), highway, or heavy construction contractors, since most general contractors limit their operations to one of these activities. These contractors construct buildings and other structures, such as dams, bridges, tunnels, and roads. They take full responsibility for the complete job, except for specified portions of the work omitted from the general contract. General contractors may do a large part of the work with their own crews, but they often sub-contract particular phases of the construction job to special-trade contractors.

Special-trade contractors usually do the work of only one trade, such as painting, carpentry, or electrical work, or of two or more closely related trades, such as plumbing and heating, or plastering and lathing. Beyond fitting their work to that of other trades, they have no responsibility for the structure as a whole. The special-trade contractors obtain orders for their work from general contractors, from architects, or from property owners. Repair work is done almost always on direct order from owners, occupants, architects, or rental agents.

There are several hundred thousand contractors (both general and special-trade); most of them operate within a limited geographical area. The great majority are small —generally employing fewer than 10 workers. Some large firms employ several thousand workers each.

Thousands of building trades workers are employed in factories, stores, mines, hotels, and most other types of large business establishments. For example, plumbers and pipefitters are employed by firms to maintain, repair, and install piping systems. In addition, large firms frequently employ crews of building trades workers to construct houses, office buildings, and other new structures. Government agencies also employ many construction craftsmen to build, maintain, and repair highway, water, and sanitation systems.

Many building trades workers are self-employed. Self-employed journeymen work directly for property owners on small jobs. They may be paid by the hour or the day, or they may be paid an agreed price for the job. They may provide the materials and include them in the price, or use materials provided by the owner. Self-employment is most common in carpentry and painting, but it also is characteristic of other skilled building trades.

The work of the skilled building craftsman is identified with a specific trade, such as carpentry or bricklaying, rather than with an individual contractor or even a broad group of contractors. Thus, a carpenter may be employed mainly by a particular builder but, in the course of a year, he also may be employed by a concrete contractor to build forms for a concrete bridge; by an electrical or plumbing contractor to build a temporary structure at a large construction site; or he may contract to do a small repair job on his own.

In some of the trades, work may be performed away from the construction site. For example, sheet-metal workers may be employed in shops where ducts are fabricated for installation in a building. In other trades, craftsmen may work in the central shop of the contractor or in fabrication shops at the job site.

Employment of these workers is distributed geographically in much the same way as the Nation's population. Thus, their employment is concentrated generally in the industrialized and highly populated States, such as California, New York, Illinois, Pennsylvania, Ohio, and Texas.

Training, Other Qualifications, and Advancement

Most training authorities, including national joint labor-management apprenticeship committees established for most of the building trades, recommend formal apprentice training as the best way to acquire the all-around proficiency of craftsmen in the building trades. Apprenticeship is a prescribed period of on-the-job training, supplemented by related classroom instruction, which is designed to develop skill by making the apprentice familiar with the materials, tools, and principles of his trade. This type of training provides the apprentice with a balanced knowledge of his field of work and enables him to perform its operations competently. Formal apprenticeship agreements are registered with a State apprenticeship agency or the U.S. Department of Labor's Bureau of Apprenticeship and Training.

Many building trades workers have acquired the skills of their trades informally by working as laborers and helpers, observing or being taught by experienced craftsmen. Some building trades craftsmen have acquired their skills, or part of their skills, by attending vocational or trade schools or by taking correspondence school courses.

Apprentices in the building trades generally are required to be between 18 and 25 years of age, and in good physical condition. The maximum age limit may be waived for veterans or others having experience or special qualifications. A high school education, or its equivalent, including courses in mathematics and the sciences, is desirable and, in a few trades, actually required. Often, applicants are given tests to determine their aptitude for a particular trade. For some skilled building trades, it is important to have considerable manual dexterity, mechanical aptitude, and an eye for proper alinement of materials.

The formal registered apprenticeship agreement generally stipulates a training period of from 2 to 5 years of relatively continuous employment and training, in addition to a minimum of 144 hours a year of related classroom instruction. The journeymen on the job and the foreman explain to the apprentice how the work is done and show him how different operations are performed and the way different tools are used. Ordinarily, most of this instruction is given by a particular journeyman to whom the apprentice is assigned. The apprentice is required to do work of progressively increasing difficulty and with progressively less supervision.

Related classroom instruction varies among the skilled building trades, but usually includes courses such as history of the trade; characteristics of the materials used; shop mathematics related to the work of the trade; and some basic principles of engineering, where appropriate (particularly for pipework, work on ventilating systems, and electrical work). It also includes sketching, elementary drafting, and interpretation of drawings; safety practices; and special-trade theory such as color harmony for painters and elementary sanitation for plumbers. Such related instruction seldom is offered in small communities where there may be only a few apprentices and a small number of journeymen in a particular trade. In these areas, apprentices receive instruction through courses offered in the local high school or by visiting instructors, generally furnished by the State. Other subject matter requirements are met through personal instruction by local journeymen and contractors or, sometimes, through correspondence courses.

The formal registered apprenticeship agreements also stipulate the length of time the apprentice is to be required to work in each major operation of the trade, as well as his rate of pay at successive intervals of advancement. The apprentice is paid at an advancing rate, usually starting at 50 percent of the journeyman's pay. The apprentice's rate increases at 6-month or 1-year intervals until a rate of about 90 percent of the journeyman's rate is reached in the final months of training. Often, advanced apprenticeship standing and pay are given to apprentices who have acquired trade skills in the Armed Forces or through trade school instruction. Advanced standing is granted on an individual basis and usually is determined by a demonstration of trade skill and knowledge.

In most communities, the apprenticeship programs are supervised by joint apprenticeship committees composed of representatives of the local employers or employer groups and the local union. The apprentices sign their apprenticeship agreements with these committees. The committee determines the need for apprentices in the locality and establishes minimum apprenticeship standards of education, experience, and training. Whenever employers cannot provide the variety of experience necessary to give an apprentice all-round instruction in the various branches of the trade, or relatively continuous employment over the entire period of apprenticeship, the committee transfers the apprentice to another employer. Where specialization by contractors is extensive—for instance, in electrical work—it is customary for the joint committee to rotate apprentices among several contractors in the trade at intervals of about 6 months. In some large cities, the local joint apprenticeship committee employs an apprenticeship program coordinator.

In areas where these committees have not been established, the apprenticeship agreement is solely between the apprentice and an employer or employer group. Many journeymen have received valuable training under this type of apprenticeship program, but such a program may involve some element of risk for the apprentice. In those instances, there is no joint committee to supervise the training offered, to settle differences over the terms and conditions of apprentice training, or to arrange a transfer in cases of personal disagreements between the apprentice and the employer. The apprentice's training depends principally on his employer's business prospects and policies. If the employer lacks continuous work or does only a restricted type of work, he cannot provide the apprentice with the broad training needed to develop journeyman skills.

In early 1970, about 150,000 men were registered in apprentice training programs in the construction trades. Additional apprentices receive their training in unregistered programs. In future years, opportunities for many young men to receive apprentice training will be available in all parts of the country. In addition, thousands of other workers will be able to learn construction trades informally.

Some indication of the location of future apprenticeship opportunities in the building trades is available from the latest data showing the geographical distribution of registered apprentices in these trades. The following eight States accounted for nearly one-half of the registered apprentices in training for selected building trades in early 1970; California, New York, Ohio, Illinois, Michigan, Texas, Pennsylvania, and Florida.

In many localities, craftsmen—most commonly construction electricians and plumbers—are required to have a journeyman's license to work at their trade. To qualify for these licenses, they must pass an examination, demonstrating a broad knowledge of the job and of State and local regulations.

Building trades craftsmen may advance in a number of ways. For example, a journeyman may become a foreman in charge of a crew. In most localities, small jobs are run by "working foremen" who work at the trade along with members of their crews. On larger jobs, the foremen supervise only. A craftsman also can become an estimator for a contractor. In this job, he estimates material requirements and labor costs to enable the contractor to bid on a particular construction project. Some craftsmen advance to jobs as superintendents on large projects. Others become instructors in trade and vocational schools, or salesmen for building supply companies. In addition, many thousands of journeymen have become contractors, particularly in the homebuilding field.

It is easier to start a small contract construction business than a small business in many other industries. Only relatively moderate financial investment is needed because liberal credit arrangements make it easier to buy materials, and it is possible to conduct a fairly substantial business from the proprietor's home. However, the contract construction field is highly competitive, and the rate of business failure is especially high among small contractors. To be successful, the proprietor of a small contracting firm must have the ability to plan work, to foresee needs and problems, to direct others, and to estimate material and labor requirements for jobs on which he is bidding. He also must have a sound knowledge of business practices and financing. Sound journeyman knowledge increases chances for success. Some States or municipalities require contractors to be licensed.

Employment Outlook

Employment in the building trades is expected to increase rapidly through the 1970's, assuming relatively full employment nationally and the high levels of economic activity needed to achieve this goal. If the high levels of economic activity are not achieved, employment in the building trades will increase at a slower rate than that projected. In addition to employment growth, tens of thousands of job openings will result from the need to replace experienced workers who transfer to other fields of work, retire, or die. Retirement and deaths alone will provide nearly 80,000 job openings in the building trades each year through the 1970's.

The rapid increase in total employment in the building trades (7 out of 10 of whom are employed in the construction industry) is expected to result primarily from a rapid rise in construction activity. The anticipated large increases in population and households and the relatively low-level of housing construction in recent years are expected to create strong pressure for new housing in the 1970's. Congress, through the Housing and Urban Development Act of 1968, has expressed its resolve that housing receive high priority among the Nation's domestic needs. Among other factors that will stimulate construction activity are a rise in expenditures for new industrial plant capacity, and higher levels of personal and corporate income. In addition, there will be a growing demand for alteration and modernization work on existing structures, as well as maintenance and repair work on the expanding highway system and on the increasing numbers of dams, bridges, and similar projects.

Employment of building trades workers outside the construction industry is expected to expand as a result of the anticipated high levels of economic activity, which will stimulate the construction of commercial and industrial buildings and, therefore, increase maintenance and repair requirements.

The increase in building trades employment is not expected to be as great as the total expansion in construction activity. Continued technological developments in construction methods, tools and equipment, and materials will permit increasing output per construction worker. One such important development in construction methods is the increasing use of prefabricated components, which are installed as complete units at the job site for almost all types of construction projects. For example, preassembled outside walls and partitions can be lifted into place in one operation, and electric circuit boxes and switchboards prewired at the factory instead of being wired by the electrician at the job site. An important extension of prefabrication is "module building" in which units, including complete rooms or buildings, are available in standard sizes. Furthermore, standardization of components will contribute to their greater use in the future.

Also expected to affect employment growth by increasing workers' efficiency are technological advances in construction tools and equipment, such as shock resistant, cordless, electric-powered tools. Items formerly unloaded and moved to the construction site by hand, such as concrete and brick, now are being moved by forklift trucks, motorized wheelbarrows, and conveyor belts. The size, speed, durability, and mobility of large cranes, construction machines, including bulldozers and scrapers, have increased considerably. Many of these machines, while they can do many times more work than the largest machines a few years ago, require only one operator. New types that reduce labor requirements also are being developed, including concrete paving machines that perform the work formerly done by four separate machines.

New and improved construction materials also are expected to limit employment growth. For example, lightweight and durable plastics are being used for a growing variety of components, including partitions, wall panels, siding, insulation, and roofing. Other new and improved products are adhesives that eliminate the need for conventional fasteners, nails that have improved holding power, paints that last twice as long as those in common use, and wood products that come from the factory prepainted with the prime coat and even the final coat.

The rates of employment growth will differ among the various building trades. Employment growth is expected to be most rapid for construction electricians; cement masons; plumbers and pipefitters; excavating, grading, and road machinery operators; and glaziers. Among the trades that will have a slower growth rate are stonemasons, marble setters, and plasterers.

Earnings and Working Conditions

Hourly wage rates paid to building trades craftsmen are among the highest paid to skilled workers. However, because construction work is seasonal and time also is lost for other reasons, average annual earnings of building trades craftsmen are not as high as the hourly rates of pay would indicate.

The hourly rates of pay for skilled workers in the building trades vary by trade and locality. Generally, the highest hourly rates are paid in the larger communities. Minimum hourly rates under union contracts for journeymen and for helpers and laborers in selected building trades in 68 large cities, on July 1, 1970, averaged as follows:

	Union minimum average hourly rate
All building trades	$6.18
Journeymen	6.54
Asbestos workers	6.69
Bricklayers	6.77
Carpenters	6.42
Cement masons (finishers)	6.02
Electricians (inside wiremen)	6.82
Elevator constructors	6.65
Glaziers	6.08
Lathers	6.44
Marble setters	6.29
Terrazzo workers	6.46
Tile setters	6.08
Painters	5.95
Paperhangers	6.02
Pipefitters	6.93
Plasterers	6.35
Plumbers	7.01
Roofers, composition	6.17
Roofers, slate and tile	5.81
Sheet-metal workers	6.75
Stonemasons	6.73
Structural-iron workers	6.72
Rodmen	6.64
Helpers and laborers	4.86
Bricklayers' tenders	5.06
Building laborers	4.78
Composition roofers' helpers	3.65
Elevator constructors' helpers	4.76
Marble setters' helpers	5.43
Terrazzo workers' helpers	5.46
Tile setters' helpers	5.15
Plasterers' laborers	5.17
Plumbers' laborers	4.95

Union wage rates for these occupations are negotiated between trade unions and employers. The minimum rates do not include holiday, vacation, or other benefit payments made or credited to the worker each pay period. They also do not include overtime, bonuses, or payments for special qualifications or for other reasons.

Construction work frequently requires prolonged standing, bending, stooping, and working in cramped quarters. Exposure to cold, hot, and inclement weather is common, as much of the work is done outdoors or in partially enclosed structures. During the winter, when the building is sufficiently enclosed, heat is sometimes provided. Many persons prefer construction work to other skilled occupations because it permits them to work outdoors.

Construction work generally is more dangerous than work in manufacturing, but the risk of injury is lessened considerably when proper work practices are followed.

Forty hours was the standard workweek for a vast majority of union building trades workers in 1970. Time and one-half generally was paid for hours worked beyond the standard workday of 8 hours. Time and one-half or double-time rates were usually paid for work on Saturdays and Sundays or holidays.

A substantial proportion of organized building trades workers are included in health, insurance, and pension programs negotiated between unions and employers, and financed entirely by employer contributions.

There are several reasons why young men may wish to consider one of the building trades as a career. These trades offer especially good opportunities for those who are not planning to go to college, but who are willing to spend several years in learning a skilled occupation. Well-trained building trades craftsmen can find job opportunities in all parts of the country. Their hourly wage rates generally are much higher than those of most other manual workers. As previously noted, building trades craftsmen with business ability have greater opportunities to establish their own businesses than workers in many other skilled occupations. In addition, there will be job opportunities for workers in the major building trades in nonconstruction industries, mainly in maintenance and repair activities. This work is generally less seasonal than contract construction work.

A principal disadvantage of work in the building trades is the employment fluctuations that result from changes in general business conditions. Another disadvantage is that even during years of high levels of construction activity, annual earnings of workers in the building trades are limited somewhat by the seasonal nature of construction work. Worktime is lost as a result of bad weather and other interruptions.

A large proportion of building trades workers are members of trade unions affiliated with the Building and Construction Trades Department of the American Federation of Labor and Congress of Industrial Organizations.

Sources of Additional Information

Information about opportunities for apprenticeship or other types of construction employment in a particular locality should be obtained from individual construction firms, employer associations, locals of the building trades unions, the nearest office of the State apprenticeship agency, or the local office of the Bureau of Apprenticeship and Training, U.S. Department of Labor. Many apprenticeship programs are supervised by local joint union-management apprenticeship committees. In these instances, an apprentice applicant may apply directly to the coordinator of the joint apprenticeship committee if there is one in his locality. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

For additional information on jobs in the building trades, inquiries should be directed to the organizations listed above:

American Federation of Labor and Congress of Industrial Organizations, Building and Construction Trades Department, 815 16th St. NW., Washington, D.C. 20006.

Associated General Contractors of America, Inc., 1957 E St. NW., Washington, D.C. 20006.

National Association of Home Builders, 1625 L St. NW., Washington, D.C. 20036.

For the names of labor organizations and trade associations concerned with specific building trades, see the discussions of individual building trades later in this chapter

---

ASBESTOS AND INSULATING WORKERS

(D.O.T. 863.381, .781, and .884)

Nature of the Work

Asbestos and insulating workers cover pipes, boilers, furnaces, ducts, and other related equipment such as cork, felt, asbestos, and fiberglass. The insulating materials which these workers install serve many purposes. For example, insulated pipes and ducts retain heat and save fuel. Insulation in refrigeration systems prevents heat absorption. Insulation in walls and ceilings provides thermal insulation and disperses sound.

Insulating materials are installed by pasting, wiring, taping, stud-welding, spraying, or plastering. When covering pipework, asbestos workers cut either block or preformed insulation to the required size and shape and then wrap this material around the pipe. Care is

Asbestos worker cuts insulating material.

required to completely cover joints, flanges, elbows, and other connections. They secure the insulating material by using wire bands, or by covering the insulating pipework further with tar paper, cloth or canvas, sewed or stapled into place.

When covering flat surfaces, asbestos workers may spot weld or screw wire studs to the surface and fasten the insulating material to the studs. They may coat joints with an asbestos cement and then wrap the joints with tape for a tight seal. In some instances, asbestos workers may spray or plaster the insulating material to a wire netting placed on the surface to be covered. The wire netting provides adhesion and structural strength. The final coat is smoothed with a trowel, straightedge, and float.

Asbestos and insulating workers use handtools such as trowels, brushes, scissors, sewing palms and heavy-duty needles, hammers, saws, pliers, and stud-welding guns. Powersaws, as well as handtools, are used to cut insulating materials.

Places of Employment

Most asbestos workers are employed by insulation contractors in new industrial and commercial construction. A substantial number are employed in the alteration and maintenance of insulated pipework in chemical plants, petroleum refineries, atomic energy installations, and other industrial establishments which have extensive steam installations for power and heating. Some large establishments which have cold storage facilities also employ asbestos workers for maintenance work.

Training, Other Qualifications, and Advancement

Most asbestos workers learn their trade through a 4-year "improvership" program similar in many respects to apprenticeship programs in other building trades. The improvership program consists of a specified period of on-the-job training in which the new worker learns how to handle the tools of the trade and to work with insulating materials.

Applicants for improvership programs are generally required to be between 18 and 30 and in good physical condition. Hourly wage rates start at about 50 percent of the journeyman's rate and increase 10 percent each year until 80 percent of the journeyman's rate is reached during the final stage of the program. Trainees are required to pass an examination which demonstrates their knowledge of the trade.

A skilled asbestos worker may advance to foreman, shop superintendent, or estimator, or he may open his own insulation contracting business.

Employment Outlook

Employment of asbestos and insulating workers—estimated at about 25,000 in 1970—is expected to increase moderately through the 1970's. In addition to the job openings resulting from the growth of the trade, other opportunities will arise from the replacement of workers who transfer to other fields of work, retire, or die. Retirements and deaths alone will result in a few hundred job openings annually through the 1970's.

Employment growth will result mainly from the anticipated large rise in the volume of construction activity, particularly of commercial and industrial buildings. (See discussion, p. 375.) The increasing use of pipe in numerous manufacturing processes and in air-conditioning and refrigeration installations will expand the need for asbestos workers in installation and maintenance work.

Earnings and Working Conditions

Union minimum hourly wage rates for asbestos workers averaged $6.69, compared with $6.54 for all journeymen in the building trades, on July 1, 1970, according to a national survey of building trades workers in 68 large cities. Among individual cities, the minimum hourly rates for asbestos workers ranged from $4.90 in Norfolk, Va., to $8.46 in Cleveland, Ohio. Straight-time hourly earnings, excluding fringe benefits or payments to health, insurance, or pension funds, for asbestos workers in 12 of the 68 cities selected to show wage rates from various regions and areas of the country, on July 1, 1970, appear in the accompanying tabulation.

City	*Rate per hour*
Birmingham	$5.55
Buffalo	7.19
Columbus	7.96
Denver	6.32
Indianapolis	7.20
Memphis	5.40
Minneapolis–St. Paul	7.05
Newark	6.24
Pittsburgh	6.67
San Diego	7.45
Springfield	6.59
Tampa	5.99

Asbestos and insulating workers spend most of the workday on their feet, either standing, bending, stooping, or squatting. Working from ladders or in tight or inaccessible spaces when covering pipes and ducts may be necessary. Removing old insulation before installing new materials may be particularly dusty and dirty.

A large proportion of the workers in this trade are members of the International Association of Heat and Frost Insulators and Asbestos Workers.

Sources of Additional Information

For further information regarding asbestos workers' improvership programs or other work opportunities in this trade, inquiries should be directed to local asbestos contractors or to a local of the International Association of Heat and Frost Insulators and Asbestos Workers. In addition, the local office of the State employment service may be a source of information about work and training opportunities, including training programs operated under the Manpower Development and Training Act.

BRICKLAYERS

(D.O.T. 861.131, .381, .781, and .884)

Nature of the Work

Bricklayers (or brickmasons) are craftsmen who construct walls, partitions, fireplaces, chimneys, and other structures from brick. They also work with various other masonry materials, such as concrete or cinder block; precast panels made of concrete, stone, or marble; porcelain glazed tile; structural tile; and terra cotta (a hard baked clay material used for ornamental purposes). They also install the brick linings of industrial kilns and furnaces.

When building a brick wall, bricklayers usually construct corners at each end of the building or wall, using plumb lines and a mason's level. Then the bricklayer is able to stretch a horizontal line (gage or course line) from corner to corner as a guide for each course or layer of brick. The line is raised when the course is completed. On longer walls, a brick is often set at fixed points along the wall, plumbed for accuracy, and the course line is trigged to this brick. The line trig overcomes sag in the course line; lessens line movement caused by the wind and by other bricklayers working on the wall; and overall, helps to insure the accuracy of the finished brickwork.

In laying brick, a bricklayer first spreads a layer or "bed" of mortar. He then applies a full cross-joint of mortar to one end of the brick to be laid or to the end of the last brick laid. In a single motion, he places the brick on the bed joint while positioning the cross-joint between the bricks to the desired width. A tap or two with his trowel positions the brick to the course line. He cuts off the excess mortar with his trowel and is then ready to lay the next brick. Once the course is completed (or sometimes sooner), the mortar joints between the brick are struck (jointed) with special finishing tools to achieve a neat and uniform appearance.

If two or more thicknesses of

brick are being laid, the bricklayer lays a "bond" or "header" course at regular intervals (usually every sixth or seventh course); that is, he arranges a course of bricks crosswise or in another bond pattern in order to tie the interior and exterior walls into a single unit. Whether the bricklayer works with brick, block, or other masonry material, the work is essentially the same.

Bricklaying requires careful, accurate work combined with planning and proper layout so that the structure will have a uniform appearance and the brickwork will line up with windows, doors, and other openings in an acceptable manner. Craftsmen in this trade mainly use handtools, including trowels, brick hammers, levels, jointers, brick cutting chisels, and rules. Powersaws are often used for cutting and fitting masonry materials; however, a bricklayer will usually cut brick with his trowel, brick hammer, or brick chisel. Journeymen bricklayers are usually assisted by hod carriers or helpers (detailed descriptions of the nature of the work, employment outlook, and other information concerning construction laborers and hod carriers appear elsewhere in the *Handbook*) who stock scaffolds with mortar, bricks, and blocks; mix the mortar; and set up and move scaffolding.

Places of Employment

The great majority of bricklayers work mainly on new construction. Some are employed also in sewer construction to build manholes and catch basins. In addition, bricklayers do a considerable amount of alteration work, especially in the larger cities where construction of fire-resistant partitions, store front remodeling, and similar modernization work are often done. They also do a substantial amount of maintenance and repair work.

Bricklayers also work for such industrial establishments as factories making glass or steel, where furnaces and kilns require special fire brick and refractory brick linings. For example, in a steel manufacturing plant, the bricklayer lines converters, cupolas, and ladles which hold molten metal. Bricklayers must have additional training to do refractory brick work.

Training, Other Qualifications, and Advancement

Most training authorities, including the National Joint (labor-management) Bricklaying Apprenticeship and Training Committee, recommend the completion of a 3-year apprenticeship program as the best way to learn this trade. Many workers in this trade have acquired bricklaying skills informally, by working as helpers or hod carriers, observing or being taught by experienced bricklayers. Many of these persons have gained additional knowledge of their trade by taking trade school courses.

Apprenticeship applicants are generally required to be between 17 and 24, but this requirement may be waived for veterans. A high school education or its equivalent is desirable. The ability to solve arithmetic problems quickly and accurately is an asset.

The apprenticeship program generally consists of 6,000 hours (3 years) of on-the-job training, in addition to related classroom instruction. In a typical 3-year bricklayer training program, the apprentice learns, among other things, to use, care for, and handle safely the tools, machines, equipment, and materials commonly used in the trade; lay, bond, and tie brickwork; build footings and foundations; do exterior brickwork such as straight wall work, steps, and arches; build columns, piers, and corners; plan and build chimneys, fireplaces, and hearths; lay stone; point brick and stone; clean stone, brick, and tile using acid solutions, and by sandblasting; cut, set, and point concrete and cinder blocks, artificial stone, and glass blocks; and fireproof and waterproof structures.

The apprentice receives related classroom instruction in blueprint reading, layout work, measurement and sketches, and welding. In fact, some apprenticeship programs conduct actual welding instructions that qualify trainees as bricklayer-welder upon completion of their training. In addition, the apprentice trainee learns the relationship between bricklaying and other building trades.

In some areas, formal apprentice training for bricklayers includes brief preliminary instruction at a vocational school or some other type of prejob instruction. This training is designed to give the apprentice a basic knowledge in the handling of tools and materials to prepare him for the start of his on-the-job training.

Hourly wage rates for bricklayer apprentices generally start at 50 percent of the journeyman rate and increase periodically until 95 percent of the journeyman's rate is reached during the last period of the apprenticeship.

A bricklayer must have an eye for straight lines and proportions. Good physical condition and manual dexterity are important assets. Since the other building craftsmen must usually fit their work to his, he should know how the parts of a structure fit together.

Bricklayers may advance to jobs as foremen. They also may become estimators for bricklaying contractors. Estimators compute material requirements and labor costs. Some journeymen advance to the position of bricklaying superintendent on large construction projects, while others may start their own bricklaying contracting business.

Employment Outlook

Employment of bricklayers—estimated at about 175,000 in 1970—is expected to increase rapidly through the 1970's. In addition to new jobs created by employment growth, thousands of job opportunities will result from the replacement of journeymen who transfer to other fields of work, retire, or die. Retirements and deaths alone will result in a few thousand job openings annually through the 1970's.

Much of the expected growth in this trade will result from the anticipated large increase in construction activity. (See discussion, p. 375.) The demand for bricklayers also will be favorably affected by such factors as the increasing use of structural clay tile for fire-resistant partitions; and ornamental brickwork for structures, such as exterior screenwalls and lobbies and foyers. In addition, the use of brick masonry load-bearing walls is growing, particularly in apartment building construction.

These favorable developments will be offset to some extent by other construction techniques that reduce the amount of brickwork per structure. For example, the use of steel framework and reinforced concrete in structures permits the elimination of load-bearing exterior brick walls. Also, the use of metal, glass, and precast concrete wall panels in buildings results in less masonry work. Other recent developments that have increased the efficiency of bricklayers include high-strength mortars that can be applied with caulking guns or compressor-powered extruders.

Earnings and Working Conditions

Hourly wage rates for bricklayers rank among the highest in the building trades. Union minimum hourly wage rates for bricklayers, on July 1, 1970, averaged $6.77, compared with an average of $6.54 for all journeymen in the building trades, according to a national survey of building trades workers in 68 large cities. Among individual cities surveyed, the minimum hourly rates for bricklayers ranged from $4.90 in Charlotte, N.C., to $8.16 in Cleveland, Ohio. Straight-time hourly earnings, excluding fringe benefits or payments to health, insurance, or pension funds, for bricklayers in 12 of the 68 cities selected to show wage rates from various areas and regions of the country, on July 1, 1970, appear in the accompanying tabulation.

City	*Rate per hour*
Atlanta	$5.40
Boston	7.25
Chicago	7.20
Detroit	7.68
Indianapolis	7.10
Memphis	6.15
Milwaukee	6.64
Newark	7.80
Sacramento	7.33
Seattle	6.95
Tampa	5.20
Topeka	6.20

Although these hourly rates indicate high annual incomes for bricklayers, time lost because of inclement weather and occasional periods of unemployment between jobs make average annual earnings less than hourly rates of pay imply.

The work of the bricklayer is active and sometimes strenuous, like the work in other building trades. It involves stooping to pick up materials, moderately heavy lifting, and prolonged standing. Most of the work is done outdoors.

A large proportion of bricklayers are members of the Bricklayers, Masons and Plasterers' International Union of America.

Sources of Additional Information

For further information regarding bricklaying apprenticeships or other work opportunities in the trade, inquiries should be directed to local bricklaying contractors; a local of the Bricklayers, Masons and Plasterers' International Union of America; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities. Some local employment service offices provide services such as screening applicants and giving aptitude tests.

General information about the work of bricklayers may be obtained from:

Associated General Contractors of America, Inc., 1957 E St. NW., Washington, D.C. 20006.

Bricklayers, Masons and Plasterers' International Union of America, 815 15th St. NW., Washington, D.C. 20005.

Structural Clay Products Institute, 1750 Old Meadow Road, McLean, Va. 22101.

CARPENTERS

(D.O.T. 860.281 through .781)

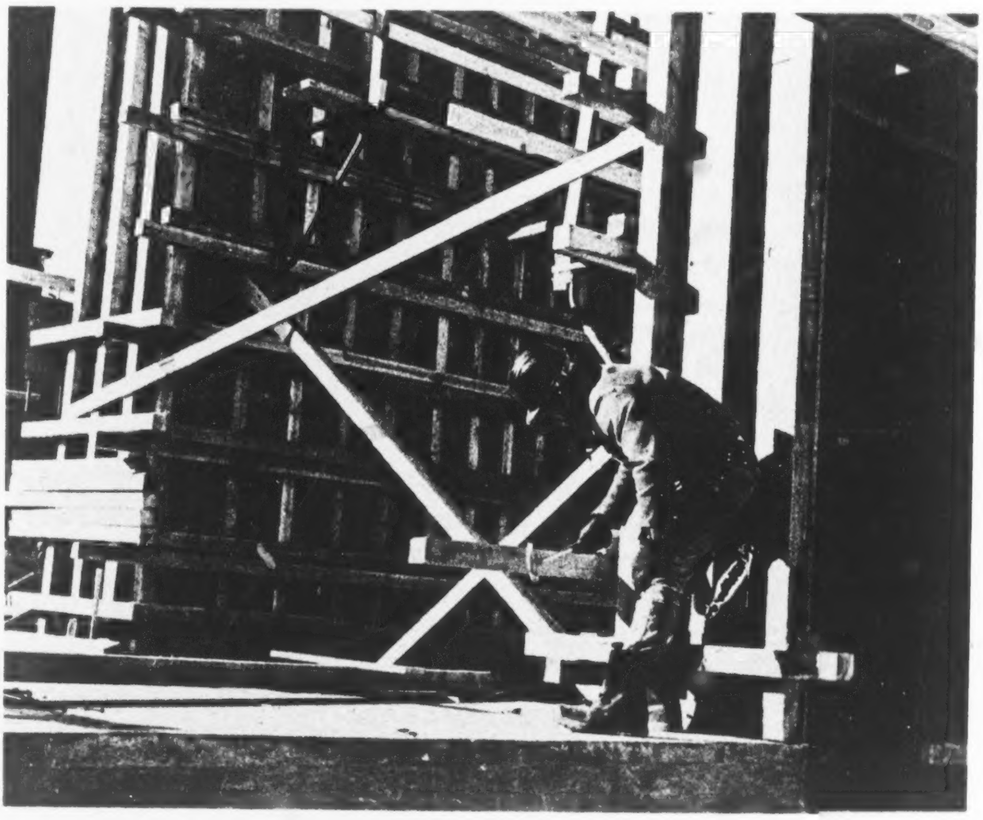
Nature of the Work

Carpenters, the largest group of building trades workers, are employed in almost every type of construction activity. They erect the wood framework in buildings, including subflooring, sheathing, partitions, floor joists, studding, and rafters. When the building is ready for trimming, they install molding, wood paneling, cabinets, window sash, doorframes, doors, and hardware. They also build stairs and lay floors. Carpenters, when doing finish work, must concern themselves with the appearance, as well as the structural accuracy, of the work.

Carpenters also install heavy timbers used to build docks, railroad trestles, and similar structures. They build the forms needed to pour concrete decks, columns, piers, and retaining walls used in bridges, buildings, and other structures. They also erect scaffolding and temporary buildings at the construction site. Carpenters also may install linoleum, asphalt tile, and similar soft-floor coverings.

Carpenters also saw, fit, and assemble plywood, wallboard, and other materials. They use nails, bolts, wood screws, or glue to fasten materials. Carpenters use handtools such as hammers, saws, chisels, and planes, and power tools such as portable power saws, drills, and rivet guns.

Because of the wide scope of the work performed in the trade, some carpenters specialize in a particular type of carpentry. For example, some specialize in installing acoustic panels on ceilings and walls; others in installing millwork and finish hardware (trimming), laying hardwood floors, or building stairs. Specialization is more common in the large cities; in small communities,



carpenters ordinarily do all types of carpentry. In rural areas, carpenters may do the work of other craftsmen, particularly painting, glazing, or roofing. Carpenters generally stay in a particular field of construction, such as home, bridge, or highway construction, or in industrial maintenance.

Places of Employment

Most carpenters working in new construction are employed mainly by contractors and homebuilders at construction sites. A substantial number, however, are employed on alteration, remodeling, or building repair. Some carpenters alternate between wage employment for contractors and self-employment on small jobs. Others work for government agencies or nonconstruction firms which employ a separate work force to perform their own construction. A large number of carpenters do maintenance work in factories, hotels, office buildings, and other large establishments. Still others are employed in shipbuilding, in mining, and in the production of many kinds of display materials.

Training, Other Qualifications, and Advancement

Most training authorities, including the National Joint (labor-management) Carpentry Apprenticeship and Training Committee recommend the completion of a 4-year apprenticeship program as the best way to learn carpentry. A substantial number of workers in this trade, however, have acquired some carpentry skills informally (for example, by working around a farm). Many of these men have also gained some knowledge of the trade by taking correspondence or trade school courses.

Apprenticeship applicants are generally required to be from 17 through 27 years of age; a high school education or its equivalent is desirable. Good physical condition, a good sense of balance, and lack of fear of working on high structures are important assets. Aptitudes which the apprentice should have include manual dexterity and the ability to solve arithmetic problems quickly and accurately.

The apprenticeship program usually consists of 8,000 hours (4 years) of on-the-job training, in addition to a minimum of 144 hours of related classroom instruction each year. During the apprenticeship period, the apprentice learns elementary structural design and becomes familiar with the common systems of frame and concrete form construction, and to use, care for, and handle safely the tools, machines, equipment, and materials used in the trade. He also learns how to lay out work, do rough framing, do outside and inside finishing work (for example, hanging doors, setting and finishing windows, fitting hardware, and flooring and stair work), weld, do acoustic and drywall construction, and erect scaffolding and shoring.

The apprentice receives related classroom instruction in drafting and blueprint reading, mathematics applicable to layout work, and the use of woodworking machines. Both in the classroom and on the job he learns the relationship between carpentry and the other building trades, because the work of the carpenter is basic to the construction process.

Hourly wage rates for apprentices usually start at about 50 percent of the journeyman rate and increase by about 5 percent in each 6-month period, until a rate of 85 to 90 percent is reached during the last period of apprenticeship.

It is important for young men interested in entering carpentry to obtain the all-around training given in apprenticeship programs, particularly because technological innovations increasingly are affecting carpentry. Carpenters having such training will have especially favorable long-range job prospects. They will be in much greater demand and have better opportunities for advancement than those in the trade who can do only the relatively simple, routine types of carpentry.

Carpenters may advance to carpenter foremen or to general construction foremen. Carpenters usually have greater opportunities than most building craftsmen to become general construction foremen, since they are involved with the entire construction process. The proportion of self-employed is higher among carpenters than among most other skilled building trades. Some self-employed carpenters are able to become contractors and employ other journeymen.

Employment Outlook

Employment of carpenters—who numbered about 830,000 in 1970—is expected to increase rapidly through the 1970's. In addition to new jobs created by employment growth, tens of thousands of jobs for carpenters will be available each year to replace experienced carpenters who transfer to other fields of work, retire, or die. Retirements and deaths alone are expected to provide more than 20,000 job openings annually.

The large rise expected in construction activity, particularly homebuilding (see discussion, p. 375), is expected to result in a growing demand for carpenters. In addition, more carpenters will be needed in the maintenance departments of factories, commercial establishments, large residential projects, and government agencies.

However, employment growth will continue to be limited by technological developments. For example, the use of construction materials prepared away from the building site is expected to increase. These materials, which include floors, partitions, and stairs, are designed for easy and speedy installation. Walls and partitions can be lifted into place in one operation. Beams and, in some instances, roof assemblies are lifted into place by cranes. Because of the standardization of prefabricated components, the use of such materials will increase further.

More widespread use of improved tools and equipment will increase the efficiency of carpenters. These products include new types of nails with improved holding properties; hence, fewer nails and less hammering are required. Stronger adhesives are being used that reduce the time needed to join pieces of wood and other materials. Power tools in widespread use include stud drivers, screwdrivers, sanders, saws, staplers, and nailing machines. One type of power tool can drill and nail in one operation. New types of scaffolding are easier to erect, adaptable to varying construction situations, and safer to use.

Employment of carpenters also will be affected by construction materials and techniques that reduce the amount of carpentry required in residential buildings. For example, where houses are framed with steel, the use of curtain-wall panels is possible. In addition to the speed with which they can be put in place, curtain-wall panels also may reduce the need for carpenters because they are available in nonwood materials such as glass, aluminum, and porcelain-coated steel. Although the use of plastics in construction is in its infancy, their greater use is expected. Already available in plastics are siding, curtain walls, partitions, roofing, ornamental screening, and insulation materials. Under development are foam plastic roofs and even entire houses of plastic that can be constructed on site.

Earnings and Working Conditions

Union minimum hourly wage rates for carpenters averaged $6.42, compared with $6.54 for all journeymen in the building trades, on July 1, 1970, according to a national survey of building trades workers in 68 large cities. Among individual cities surveyed, minimum hourly rates for carpenters ranged from $4.45 in Charlotte, N.C., to $8.10 in Cleveland, Ohio. Straight-time hourly earnings, excluding fringe benefits or payments to health, insurance, or pension funds, for carpenters in 12 of the 68 cities selected to show wage rates from various areas and regions of the country, on July 1, 1970, appear in the accompanying tabulation.

City	*Rate per hour*
Atlanta	$6.20
Boston	6.65
Chicago	6.85
Denver	6.02
Detroit	7.36
Los Angeles	5.98
New Orleans	5.72
Philadelphia	7.05
Pittsburgh	7.00
St. Louis	6.61
San Diego	6.21
Seattle	6.10

As other building trades, the work of the carpenter is active and sometimes strenuous, but exceptional physical strength is not required. However, prolonged standing, as well as climbing and squatting, is often necessary. Carpenters risk injury from slips or falls, from contact with sharp or rough materials, and from the use of sharp tools and power equipment. Many young persons like carpentry because they are able to work outdoors.

A large proportion of carpenters are members of the United Brotherhood of Carpenters and Joiners of America.

Sources of Additional Information

For further information regarding carpentry apprenticeships or other work opportunities in this trade, inquiries should be directed to local carpentry contractors or general contractors; a local union of the United Brotherhood of Carpenters and Joiners of America; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities. Some local employment services screen applicants and give aptitude tests.

General information on apprenticeship in this trade is also available from:

Associated General Contractors of America, Inc., 1957 E St. NW., Washington, D.C. 20006.

United Brotherhood of Carpenters and Joiners of America, 101 Constitution Ave. NW., Washington, D.C. 20001.

CEMENT MASONS (CEMENT AND CONCRETE FINISHERS)

(D.O.T. 844.884 and 852.884)

Nature of the Work

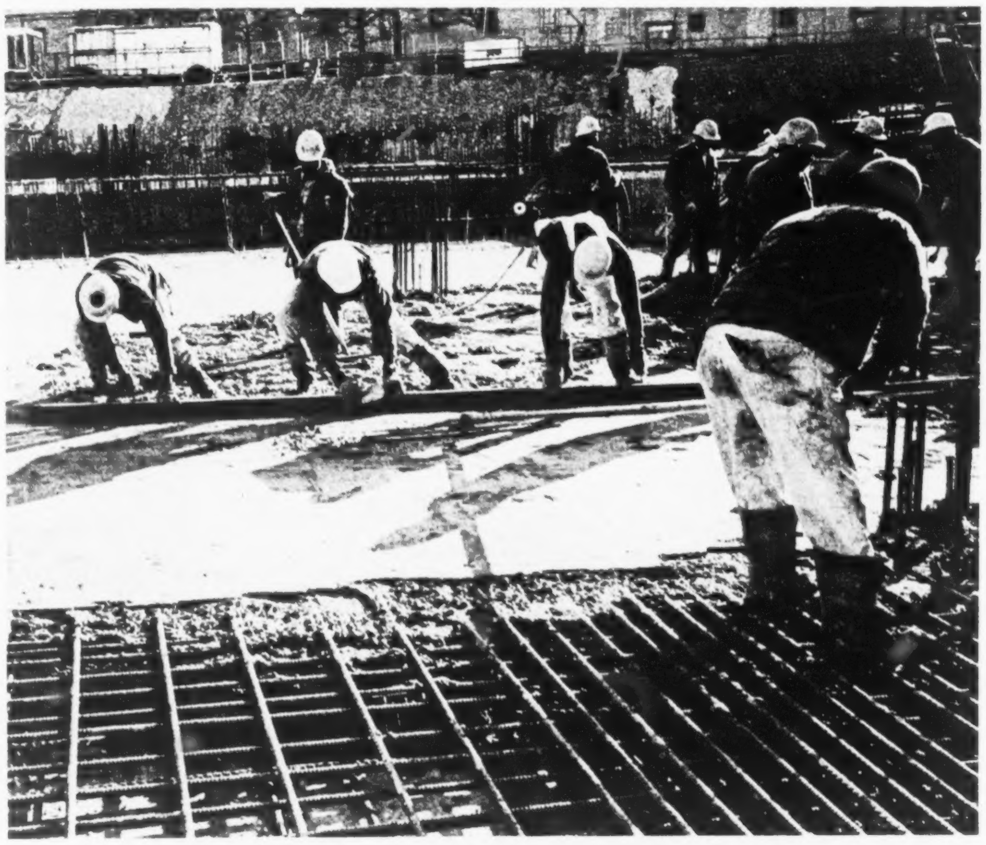
The principal work of cement masons is finishing the exposed concrete surfaces on many types of construction projects. These projects range from small jobs, such as the finishing of patios, floors, and sidewalks, to work on huge dams, miles of concrete highways, foundations and walls of large buildings, airport runways, and missile launching sites. On small projects, a cement mason, assisted by one or two helpers, may do all the concrete work; on large projects, a crew of several cement masons and many helpers may be employed.

In preparing the site for pouring (placing) the concrete mixture, the cement mason makes sure that the forms, which hold the concrete, are set for the desired pitch and depth of the concrete mixture and are properly alined. On larger (and wider) pours, a screed (guide) may be placed to section the pour into 12–15 foot widths, which allows easier handling and greater accuracy in the initial leveling process.

The cement mason directs the pouring of the concrete. He usually supervises the laborers who use shovels or special rakes to "strike off" (place and spread the mixture to its approximate level) the concrete. The cement masons then level the surface further using a "straightedge" (a rod made of wood or lightweight metal long enough to extend across the freshly poured concrete). The concrete is ready for its intermediate and final finishing. The finisher uses special tools, such as a float, whip, or darby, to fill minor depressions and remove high spots. This agitation tends to draw surface fines (a rich mixture of cement and fine sand) to the top and imbed coarser aggregates.

Final finishing is usually delayed until the concrete has hardened sufficiently to support the weight of a finisher on kneeboards. While the concrete is still workable, the craftsmen use handtools—a wood or magnesium float and a finishing trowel—to bring the concrete to the proper consistency and obtain the desired finish. Concrete finishing also may be done with the aid of power-operated trowels; however, edges, corners, and other inaccessible places for power-operated tools must still be finished by hand.

On most small building projects, such as sidewalks, driveways, and patios, concrete finishing generally



involves hand operations. On highways and other large-scale projects, however, power-operated floats and cement finishing machines are used extensively.

On concrete work which is exposed (for example, columns, piers, ceilings, and wall panels), cement masons correct surface defects and air pockets (called honeycombs) when the forms are stripped. This involves preparing the surface with a rubbing brick (silicon carbide) to remove high spots. A rich cement mixture is rubbed into the concrete surface using a sponge rubber float or piece of burlap cloth to fill imperfections and voids. The end result is a smooth uniform appearance.

Some cement masons specialize in laying a mastic coat (a fine asphalt mixture) over concrete, particularly in buildings where sound-insulated or acid-resistant floors are specified. Heavy hand tools are used to smooth the hot mastic.

The cement mason must know materials and be familiar with various cement and concrete mixes which speed or slow the setting time, and those which are used for weight-supporting walls or surfaces of specified strengths. Because of the effects that heat, cold, and wind have on the curing of cement, the skilled mason must recognize by sight and touch what is occurring in the cement mixture so that he may be able to prevent structural defects.

Places of Employment

Cement masons work principally on large buildings, but many are employed on highway or other nonbuilding construction. Cement masons work directly for general contractors who construct entire projects such as highways, or large industrial, commercial, and residential buildings. They also work for concrete contractors who do only the concrete work on a large construction project or who work on smaller projects such as sidewalks, driveways, and basement floors. Some install composition resilient floors, such as trowel applied epoxies, latex underlayments, and simulated terrazzo floors for specialty floor contractors. A small number are employed by municipal public works departments, public utilities, and manufacturing firms which do their own construction. Some cement masons are self-employed and do small cement jobs, such as sidewalks, driveways, patios, and curb and gutter work.

Training, Other Qualifications, and Advancement

Most training authorities, including the National Cement Masonry, Asphalt, and Composition Joint (labor-management) Apprenticeship and Training Committee, recommended the completion of a 3-year apprenticeship program as the best way to learn this trade. A substantial number of workers, however, have acquired cement masonry skills informally by working on building and road construction jobs as laborers assisting cement masons. Others have worked with specialty contractors constructing sidewalks and doing other masonry.

Apprenticeship applicants generally are required to be between 18 and 25. Good physical condition and manual dexterity are important assets.

The apprenticeship program usually consists of 6,000 hours (3 years) of on-the-job training, in addition to related classroom instruction. During the apprenticeship period, the apprentice learns, among other things, to use and handle the tools, equipment, and materials of the trade. He also learns finishing, layout work, and safety techniques. The apprentice receives related classroom instruction in subjects such as applied mathematics and related sciences, blueprint reading, architectural drawing, estimating materials and costs, and local building regulations. Although a high school education is not required, education above the grade school level, preferably including mathematics, is needed to understand the classroom instruction.

Cement masons may advance to foremen or become estimators of material requirements and labor costs for concrete contractors. Others may start their own concrete contracting business.

Employment Outlook

Employment of cement masons —estimated at about 65,000 in 1970—is expected to increase very rapidly through the 1970's. In addition to new jobs created by employment growth, thousands of job opportunities will result from the replacement of craftsmen who transfer to other fields of work, retire, or die. Retirements and deaths alone will result in several hundred job openings annually through the 1970's.

Employment of cement masons is expected to increase mainly because the anticipated rapid increase in construction activity (see discussion, p. 375) will be accompanied by the growing use of concrete and concrete products. Prestressed concrete makes possible wide spans where column-free construction is desired. Lightweight concrete wall panels that are fire- and weather-resistant are being used increasingly on nonload-bearing walls. These panels, available in different finishes, colors, and designs, can be speedily fastened into place. In some instances, buildings made with concrete wall panels can be easily dismantled and reerected elsewhere. Artistic and functional shapes can be incorporated into structures where prestressed concrete is used. In addition, the use of concrete and concrete products has expanded to include thinshell dome roofs, ornamental grill work, and slab and arch roofs in residential buildings; and bridge girders, columns, piles, and beams. Also, concrete can be poured year round by using heated, temporary shelters made of sheet plastic.

Employment of cement masons is not expected to increase as rapidly as the use of cement and concrete products. Many concrete products are now precast and generally do not require finishing. The efficiency of onsite masons also has increased through new and improved construction methods, materials, and equipment. Concrete slabs for floors, walls, and roofs can be processed at ground level and raised into place with synchronized hydraulic jacks or cranes. For certain jobs, concrete can be applied pneumatically through hoses. Glass-fiber-reinforced plastic forms provide a smooth surface and reduce rubbing and patching work. Reusable steel and plastic-covered wood forms are now available. Adhesives reduce the need for bolts and other fasteners. Worker efficiency has also been increased because of new machines, including powered concrete conveyors, such as powered wheelbarrows; portable, powered screeds; electric concrete vibrators; hydraulic joint-forming machines; powered concrete cutting saws; and cement-finishing machines.

Earnings and Working Conditions

Union minimum hourly wage rates for cement masons averaged $6.02, compared with $6.54 for all journeymen in the building trades, on July 1, 1970, according to a national survey of building trades workers in 68 large cities. Among individual cities surveyed, the minimum hourly rates for cement masons ranged from $3.93 in Charlotte, N.C., to $8.06 in Buffalo, N.Y., and Cleveland, Ohio. Straight-time hourly earnings, excluding fringe benefits or payments to health, insurance, or pension funds, for cement masons in 12 of the 68 cities selected to show wage information from various areas and regions of the country, on July 1, 1970, appear in the accompanying tabulation.

City	*Rate per hour*
Birmingham	$4.68
Boston	7.35
Columbus	6.15
Dallas	5.40
Denver	5.85
Fresno	5.62
Jacksonville	4.35
Milwaukee	5.90
Newark	7.80
Pittsburgh	6.70
Salt Lake City	5.87
Washington, D.C.	5.93

Cement masons usually receive premium pay for hours worked in excess of the regularly scheduled workday or workweek. Overtime work for these craftsmen often occurs because once concrete has been poured, the work must be completed.

The work of the cement mason is active and strenuous, like the work of skilled building tradesmen generally. Since most cement finishing is done on floors or at ground level, the cement mason is required to stoop, bend, or kneel. Much of his work is done outdoors.

A large proportion of cement masons are union members. They belong either to the Operative Plasterers' and Cement Masons' International Association of the United States and Canada, or to the Bricklayers, Masons and Plasterers' International Union of America.

Sources of Additional Information

For further information regarding cement mason apprenticeships or other work opportunities in the trade, inquiries should be directed to local cement finishing contractors; locals of unions previously mentioned; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of cement masons may be obtained from:

Associated General Contractors of America, Inc., 1957 E St. NW., Washington, D.C. 20006.

Bricklayers, Masons and Plasterers' International Union of America, 815 15th St. NW., Washington, D.C. 20005.

Operative Plasterers' and Cement Masons' International Association of the United States and Canada, 1125 17th St. NW., Washington, D.C. 20036.

CONSTRUCTION LABORERS AND HOD CARRIERS

(D.O.T. 809.887; 844.887; 850. through 852.887; and 859. through 862.887)

Nature of the Work

Construction laborers work on all types of building construction, as well as on other types of construction projects, such as highways, dams, pipelines, and water and sewer projects. Their work includes the loading and unloading of construction materials at the worksite and the shoveling and grading of earth. Laborers stack and carry materials, including small units of machinery and equipment, and do other work that aids building craftsmen. They also erect and dismantle scaffolding, set braces to support the sides of excavations, and clean up rubble and accumulated debris to provide clear work areas.

On alteration and modernization jobs, laborers tear out the existing work. They perform most of the work done by wrecking and salvage crews during the demolition of buildings.

When concrete is mixed at the worksite, laborers unload and handle materials and fill handloaded mixers with ingredients. Whether the concrete is mixed on-site or hauled in by truck, laborers pour and spread the concrete, and spade or vibrate it to prevent air pockets. In highway paving laborers clean the right-of-way, fine grade and prepare the site, handle and place the forms into which wet concrete is poured, and cover new pavement with straw, burlap, or other materials to prevent excessive drying.

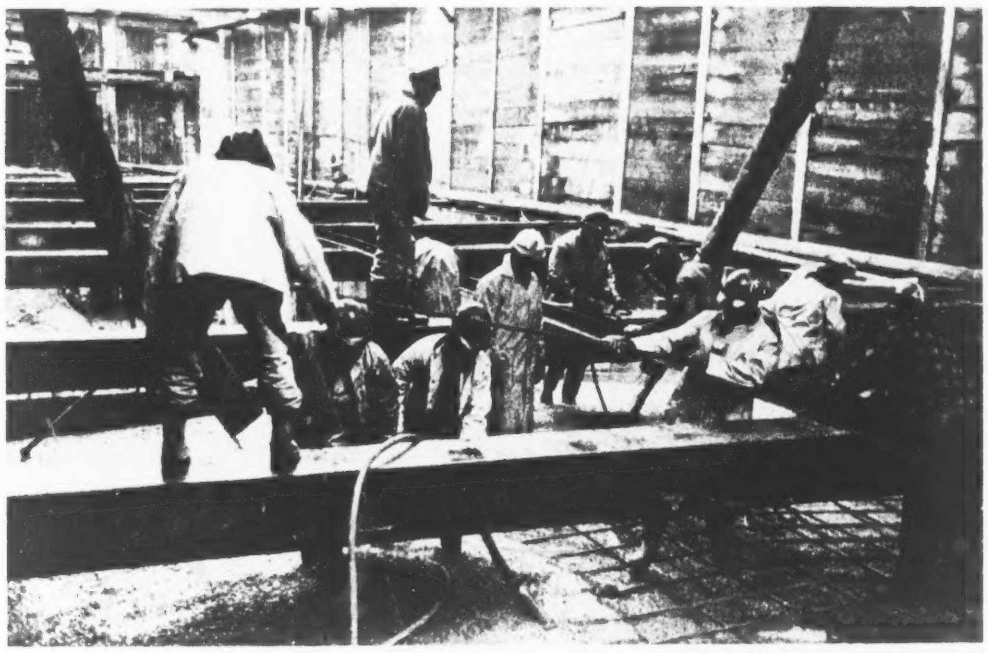
Bricklayers' tenders and *plaster tenders*, both commonly known as hod carriers, serve journeymen in their respective trades, mixing and supplying materials, setting up and moving portable scaffolding, and providing the many other services needed. Hod carriers must be familiar with the work of the journeymen and have some knowledge of the materials and tools used. Laborers also tend cement finishers, and some who have started as laborers have learned that trade.

Building and construction laborers are commonly classified as unskilled workers, but this term can be misleading. Their work covers a wide range of requirements. Many types of construction-laborer and hod-carrier jobs require training and experience, as well as a broad knowledge of construction methods, materials, and operations.

Rock blasting, rock drilling, tunnel construction, and concrete work are examples of work in which "know-how" is important. Construction laborers who work with explosives drill holes in rock, handle explosives, and set charges. These workers must know the effects of different explosive charges under varying rock conditions so that proper measures can be taken to prevent injury and property damage. Construction laborers learn how to handle and use blasting materials through job experience and instruction from foreman in charge of blasting work. Also, in the construction of tunnels, and dam and bridge foundations, contruction laborers must have specific on-the-job experience. They do all the work in the boring and mining of a tunnel, including operations which would be handled by journeymen if the job were located above ground.

Places of Employment

Laborers are employed by all types of construction contractors. In addition, a large number are employed by State and municipal public works and highway departments, and by public utility companies in road repairing and maintenance, and excavating.



Training, Other Qualifications, and Advancement

Little formal training is required to obtain a job as a building or construction laborer. Generally, to be employed in these jobs, a young man must be at least 18 years of age and in good physical condition. A laborer's first job is usually on the simplest type of work, but as he gains experience, he does more difficult work. If he works closely with a skilled craftsman for several years, he may be able to pick up the skills of the trade. However, in their work as construction laborers, relatively few workers have such opportunities.

Many tasks assigned to laborers have become too complex to learn through a lengthy on-the-job training period. Recognizing these problems, contractors and unions have established formal training programs, lasting 4 to 8 weeks, in many areas of the country.

Employment Outlook

Employment of construction laborers and hod carriers—estimated at about 815,000 in 1970—is expected to increase slowly through the 1970's. However, thousands of additional job openings will arise from the replacement of construction laborers who transfer to other occupations, retire, or die. Retirements and deaths alone are expected to provide nearly 15,000 job openings annually.

The anticipated large increase in construction activity (see discussion p. 375) is expected to result in a growing demand for laborers and hod carriers, but the increase in their employment will be somewhat limited by more widespread use of mechanized equipment. For example, construction materials formerly handled at the construction site, such as brick, concrete, and lumber, are moved by forklift truck, powered wheelbarrows, and conveyor belts. Materials are lifted to the upper floors of multistoried buildings by automatic lifts and heavy duty cranes. The use of earth moving machines, including specialized equipment such as trenchers and front-end loaders, is also increasing.

Earnings and Working Conditions

Union minimum hourly wage rates for bricklayers' tenders and building laborers averaged $5.06 and $4.78, respectively, on July 1, 1970, according to a national survey of building trades workers in 68 large cities. Among individual cities surveyed, the minimum hourly rates for bricklayers' tenders ranged from $2.70 in Norfolk and Richmond, Va., to $6.57 in Toledo, Ohio. The rates for building laborers ranged from $2.60 in Norfolk and Richmond, Va., to $6.52 in Cleveland, Ohio. Straight-time hourly earnings, excluding fringe benefits or payments to health, insurance, or pension funds, for bricklayers' tenders and building laborers in 12 of the 68 cities selected to show wage rates from various areas and regions of the country, on July 1, 1970, appear in the accompanying tabulation.

City	*Rate per hour-*	
	Bricklayers' tenders	*Building laborers*
Albuquerque	$3.91	$3.61
Baltimore	3.80	3.65
Buffalo	5.89	5.89
Columbus	5.02	4.86
Des Moines	4.91	4.91
Fresno	5.25	4.94
Los Angeles	5.00	4.55
Omaha	4.83	4.70
Phoenix	4.99	4.38
Providence	5.00	5.00
Seattle	5.20	4.90
Tampa	3.73	3.58

Construction work is physically strenuous, since it requires frequent bending, stooping, and heavy lifting. Much of the work is performed outdoors. Many laborers are members of the Laborers' International Union of North America.

Sources of Additional Information

For further information regarding work opportunities as a construction laborer, inquiries should be directed to local building or construction contractors, or a local of the Laborers' International Union of North America. In addition, the local office of the State employment service is a source of information about work opportunities.

General information about the work of construction laborers may be obtained from:

Laborers' International Union of
North America, 905 16th St. NW.,
Washington, D.C. 20006.

ELECTRICIANS (CONSTRUCTION)

(D.O.T. 821.381; 824.281; and 829.281 and .381)

Nature of the Work

Construction electricians lay out, assemble, install, and test electrical fixtures, apparatus, and wiring used in electrical systems. These systems provide heat, light, power, air conditioning, and refrigeration in residences, office buildings, factories, hospitals, schools, and other structures. Construction electricians also install and connect electrical machinery, electronic equipment, controls, and signal and communications systems. (Maintenance electricians do work which is similar in many respects to that performed by construction electricians. A discussion of maintenance electricians is presented elsewhere in the *Handbook.*)

Construction electricians usually follow blueprints and specifications when installing electrical components. If there is no electrical drawing, the electrician terminates the incoming electrical service into a central load center. The electrician then installs interior circuits and outlets according to the amount of electrical current expected to be used in the various sections of the building. He also installs fuses or circuit breakers of the proper rating in the incoming and interior circuits to prevent overloading, which causes overheating of wires, appliances, and motors. The construction electrician must know and follow National Electrical Code regulations and, in addition, must fulfill State, county, and municipal regulations.

When installing wiring, the construction electrician uses a mechanical or hydraulic bender to shape conduit (pipe or tubing). The conduit usually must fit inside partitions, walls, concealed areas of the ceiling, or within other narrow and inaccessible spaces. He pulls insulated wires or cables through the conduit to complete the circuit between the electrical outlet and the switch. Next, he connects the wires or cables to circuit breakers, switch-gear motors, transformers, or other components. Wires are spliced (joined) by soldering or mechanical means. When these operations are completed, the electrician tests the electrical circuits to make sure that the entire system is properly grounded, the connections properly made, and the circuits do not carry excessive current.

The electrician furnishes his own handtools, such as pliers, screwdrivers, brace and bits, knives, and hacksaws. The employer furnishes test meters and heavier tools and equipment, such as pipe threaders, conduit benders, chain hoists, electric drills, power fasteners, and ladders. In residential construction, heavier tools are not usually required.

Places of Employment

Most construction electricians work for electrical contractors. Substantial numbers are self-employed. Others work for government agencies or business establishments that do their own electrical work. Construction electricians usually work for a large number of different employers during their work life because of the intermittent needs of individual contractors. However, many construction electricians work for the same electrical contractor for long periods of time. During a single year, a construction electrician may work for an electrical contractor in the construction of new homes or office buildings, for a manufacturing firm in remodeling its plant or offices, or he may do electrical repairs for homeowners or business firms.

Training, Other Qualifications, and Advancement

Most training authorities, including the National Joint (labor-management) Apprenticeship and Training Committee for the Electrical Industry, recommend the completion of a 4-year apprenticeship program as the best way to learn all aspects of the electrical trade. However, in the past, some construction electricians have acquired skills of the trade informally by working for many years as helpers, observing or being taught by experienced craftsmen. Many of these persons have gained additional knowledge of the trade by taking trade school or correspondence courses, or through special training when in the Armed Forces.

The International Brotherhood of Electrical Workers and the National Electrical Contractors Association have jointly developed an extensive apprenticeship program. Apprenticeship applicants generally are required to be between 18 and 24, but exceptions may be made for veterans. A high school education is required; courses in mathematics and physics are desirable. Applicants are usually required to take tests to determine their aptitude for the trade.

All apprenticeship programs are conducted under written agreement between the apprentice and the local joint union-management apprenticeship committee, which supervises the training. The committee determines the need for apprentices in the locality, establishes minimum apprenticeship standards, and schedules a diversified, rotating work program. This program is designed to give the apprentice all-round training by having him work for several electrical contractors who engage in particular types of work.

The apprenticeship program usually requires 8,000 hours (4 years) of on-the-job training, in addition to a minimum of 144 hours of related classroom instruction each year. In a typical 4-year training program, the apprentice learns, among other things, to use, care for, and handle safely the tools, equipment, and materials commonly used in the trade; do residential, commercial, and industrial electrical installations; and maintain and repair installations. In addition, he receives related classroom instruction in subjects such as electrical layout, blueprint reading, mathematics, and electrical theory, including electronics. After completing their apprenticeship, many journeymen electricians enroll in courses, which may include advanced electronics, to keep abreast of the latest developments in this rapidly changing occupation.

Hourly wage rates of apprentices usually start at 40 to 50 percent of the journeyman rate and increase by 5 percent in each 6-month period until 80 to 85 percent of the jouneyman rate is reached during the last period of the apprenticeship.

An experienced construction electrician who has learned all the aspects of the craft through apprenticeship can transfer readily to other types of electrical work. For example, many take jobs as maintenance electricians in factories or in commercial establishments, and others work as electricians in shipbuilding and aircraft manufacturing.

Because improperly installed electrical work is hazardous, most cities require electricians to be licensed. To obtain a license, the electrician must pass an examination which requires a thorough knowledge of the craft and of State and local building codes.

Many journeymen electricians become foremen or superintendents for electrical contractors on construction jobs. These craftsmen may also become estimators for electrical contractors, computing material requirements and labor costs.

Many construction electricians go into business for themselves. As they expand their activities, they may employ other workers and become contractors. In most large urban areas, a master electrician's license is required to engage in an electrical contracting business.

Employment Outlook

Employment of construction electricians—who numbered about 190,000 in 1970—is expected to increase very rapidly through the 1970's. In addition to the growth that is anticipated in the trade, many thousands of job opportunities will result from the replacement of journeymen who transfer to other types of electrical work, leave the trade for other reasons, retire, or die. Retirements and deaths alone will result in a few thousand job openings annually.

The increase in employment of electricians is expected mainly because of the anticipated large expansion in construction activity. (See discussion, p. 375.) Other factors expected to contribute to the growth of this trade are greater requirements for electric outlets, switches, and wiring in homes to accommodate the increasing use of appliances and air-conditioning systems; and the extensive wiring systems needed for the installation of electronic data-processing equipment and electrical control devices being used increasingly in commerce and industry. Other recent developments expected to expand the demand for construction electricians include an increase in the number of "all-electric" homes, and the use of outdoor radiant heating, and snow- and ice-melting systems.

Technological developments are expected to limit the employment growth of this trade. A major technological development increasing the efficiency of electricians is the prefabrication of electrical equipment. For example, preassembled conductors and raceways that can be installed in one operation are available. Switch boxes and switchboards, which formerly had to be wired on site, are now preassembled at the factory. Also available are "packaged" (preassembled and prewired) ceiling units, which the electrician connects to the power source, eliminating the need to wire the complete system and install the fixtures.

Improved tools and equipment being used increasingly by electricians include more efficient conduit benders; multiple spindle drills; cordless electric drills, saws, and other tools; and "kits" of splicing materials that have reduced the time needed to do field insulation of cable splices.

Earnings and Working Conditions

Hourly wage rates of construction electricians are among the highest in the skilled building trades. Furthermore, because the seasonal nature of construction work affects electricians less than most other construction workers, their annual earnings generally are among the highest in the building trades.

Union minimum hourly wage rates for electricians averaged $6.82, compared with $6.54 for all journeymen in the building trades on July 1, 1970, according to a national survey of building trades workers in 68 large cities. Among individual cities surveyed, the union minimum hourly rates for construction electricians ranged from $5 in Charlotte, N.C., to $8.11 in Buffalo, N.Y. Straight-time hourly earnings, excluding fringe benefits or payments to health, insurance, or pension funds, for construction electricians in 12 of the 68 cities selected to show wage rates from various areas and regions of the country, on July 1, 1970, appear in the accompanying tabulation.

City	*Rate per hour*
Birmingham	$6.20
Columbus	7.68
Des Moines	6.75
Erie	7.20
Fresno	6.88
Grand Rapids	6.52
Little Rock	5.65
Louisville	7.13
Providence	6.45
Spokane	6.13
Trenton	6.85
Washington, D.C.	6.85

The work of the construction electrician, like that of other building trades, is active but does not require great physical strength. Frequently, the construction electrician stands for prolonged periods; sometimes he works in cramped quarters. Because most of his work is indoors, the construction electrician is less exposed to unfavorable weather conditions than most other skilled building trades workers. Electricians risk falls from ladders and scaffolds, cuts from sharp tools, electrical shock, blows from falling objects, and burns from "live" wires. However, safety practice learned during apprenticeship and other types of training have helped to reduce the injury rate for these workers. The number of injuries per million man-hours worked by employees in contract electrical work has been lower than in contract construction work as a whole, but higher than that for production workers in manufacturing industries.

A large proportion of construction electricians are members of the International Brotherhood of Electrical Workers.

Sources of Additional Information

For further information regarding electrician apprenticeships or other work opportunities in the trade, inquiries should be directed to local electrical contractors; a local union of the International Brotherhood of Electrical Workers; a local joint union-management apprenticeship committee, or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities. Some local employment service offices provide services such as screening applicants and giving aptitude tests.

General information about the work of electricians may be obtained from:

International Brotherhood of Electrical Workers, 1125 15th St. NW., Washington, D.C. 20005.

National Electrical Contractors Association, 1730 Rhode Island Ave. NW., Washington, D.C. 20036.

National Joint Apprenticeship and Training Committee for the Electrical Industry, 1730 Rhode Island Ave. NW., Washington, D.C. 20036.

ELEVATOR CONSTRUCTORS

(D.O.T. 825.381)

Nature of the Work

Elevator constructors (also called *elevator mechanics*) assemble and install elevators, escalators, dumb waiters, and similar equipment. In new buildings, this equipment is installed on-site while the building is under construction. In older buildings, these craftsmen may replace an earlier installation with the latest available elevator equipment. Once the elevator equipment is in service, elevator mechanics perform regular maintenance and repair work. Installation or repair work is usually performed by small crews consisting of skilled mechanics and their helpers.

In elevator construction work, the crew first installs the guide rails of the car in the elevator shaft of the building. Then they install the hoisting machines, the car frame and platform, the counterweight, the elevator chassis, and the control apparatus. Next, the car frame is connected to the counterweight with cables, the cab body and roof are installed, and the control system is wired. Finally, the entire assembly, including cables, wire, and electrical control apparatus, is carefully adjusted and tested.

Alteration work on elevators is important because of the rapid rate of innovation and improvement in elevator engineering. This work is similar to new installation work because all elevator equipment except the old rail, car frame, platform, and counterweight is generally replaced. In maintenance and repair work, elevator mechanics inspect elevator and escalator installations periodically and, when necessary, adjust cables and lubricate or replace parts.

To install and repair modern elevators, most of which are electrically controlled, elevator constructors must have a working knowledge of electricity, electronics, and hydraulics. They also must be able to repair electric motors, as well as control and signal systems. Because of the variety of their work, they use many different handtools, power tools, and mechanical and electrical testing meters and gages.

Elevator constructor adjusts door.

Places of Employment

Most of the estimated 15,000 journeymen elevator constructors employed in 1970, worked for elevator manufacturers, doing new installation and modernization work and elevator servicing. Some elevator constructors are employed by small, local contractors who specialize in elevator maintenance and repair. Others work for government agencies or business establishments that do their own elevator maintenance and repair. Elevator constructors also are employed as elevator inspectors for municipal or other government licensing and regulatory agencies.

Training, Other Qualifications, and Advancement

Although elevator constructors are highly skilled craftsmen, training is comparatively informal and is obtained through employment as a helper for a number of years. The helper-trainee must be at least 18 years of age, in good physical condition, and have a high school education or its equivalent, preferably including courses in mathematics and physics. Mechanical aptitude and an interest in machines are important assets.

To become a skilled elevator mechanic, at least 2 years of continuous job experience, including 6 months' on-the-job training at the factory of a major elevator firm, is usually necessary. During this period, the helper learns to perform all of the operations involved in the installation, maintenance, and repair of elevators, escalators, and similar equipment. The helper-trainee generally attends evening classes in vocational schools. Among the subjects studied are mathematics, physics, electrical and electronic theory, and proper safety techniques.

Elevator mechanics may advance to positions as foremen for elevator manufacturing firms. A few may establish an individually owned small contracting business; however, opportunities are limited.

Employment Outlook

A moderate increase in employment of elevator constructors is expected through the 1970's. In addition to new jobs created by employment growth, a few thousand job opportunities for new workers will result from the replacement of experienced workers who transfer to other fields of work, retire, or die. Employment growth and retirements and deaths in this small occupation will provide a few hundred job openings annually.

More elevator constructors will be needed as a result of the anticipated large expansion in new industrial, commercial, and large residential buildings. (See discussion p. 375.) In addition, technological developments in elevator and escalator construction will spur modernization of older installations and thus will contribute to the growing need for these craftsmen. For example, modern high speed elevators having automatic control systems require more work and higher skill for the installation and adjustment of electrical and electronic controls.

Earnings and Working Conditions

Both the hourly wage rates and the annual earnings of elevator constructors are among the highest in the skilled building trades. These craftsmen lose less worktime because of seasonal factors than do most other building trades workers.

Union minimum hourly wage rates for elevator constructors averaged $6.65, compared with $6.54 for all journeymen in the building trades, on July 1, 1970, according to a national survey of building trades workers in 68 large cities. Among the individual cities surveyed, the minimum hourly rates for elevator constructors ranged from $5.09 in Norfolk, Va., to $8.12 in Cleveland, Ohio. Straight-time hourly earnings, excluding fringe benefits or payments to health, insurance, or pension funds, for elevator constructors in 12 of the 68 cities selected to show wage information from various areas and regions of the country, on July 1, 1970, appear in the accompanying tabulation.

City	*Rate per hour*
Baltimore	$6.46
Chicago	7.64
Denver	5.69
Fresno	7.58
Houston	5.56
Jacksonville	5.27
Little Rock	5.19
Los Angeles	6.63
Madison	6.04
Philadelphia	6.83
Providence	6.07
Rochester	6.60

Elevator construction involves lifting and carrying heavy equipment and parts, but this is usually done by helpers. Most of the work is indoors—sometimes in cramped and awkward positions.

Most elevator constructors are members of the International Union of Elevator Constructors.

Sources of Additional Information

For further information regarding work opportunities as a helper in this trade, inquiries should be directed to elevator manufacturers, elevator constructors, or a local of the International Union of Elevator Constructors. In addition, the local office of the State employment service may be a source of information about work opportunities in this trade.

General information about the work of elevator constructors may be obtained from the International Union of Elevator Constructors, 12 South 12th St., Philadelphia, Pa. 19107.

FLOOR COVERING INSTALLERS

(D.O.T. 864.781)

Nature of the Work

Floor covering installers (also called *floor covering mechanics* and *floor layers*) install, replace, and repair a number of floor coverings. These include resilient tile, linoleum and vinyl sheet goods, and carpeting. The craftsman installs these coverings over wood, concrete, metal, and other subfloors of residential, commercial, and industrial buildings. Areas covered may vary in size from a small kitchen or bathroom to a large supermarket floor or hotel lobby.

When installing resilient floor covering (such as asphalt tile or vinyl sheet goods), the floor covering installer first inspects the floor to be sure that it is firm, dry, smooth, and free of loose dust or dirt. If he

finds the floor inadequate, he prepares it for covering. He may sand a rough or painted floor; fill cracks, indentations, or other irregularities with a filler material; or, if a floor is extremely uneven, resurface it with plywood, hardwood, or synthetic underlayments.

In newly poured concrete floors or floors laid over earthwork at ground level or below, the installer also may test for moisture content. If the moisture in the floor is too great, he may suggest postponing installation of floor covering or recommend a type of floor covering technique particularly suited to the condition of the floor. For this reason, the installer should be familiar with the many types of adhesives and floor coverings recommended by manufacturers for specific subfloor conditions.

The craftsman then prepares for the installation of resilient floor covering by carefully measuring and marking off the floor in accordance with the floor covering plan. The plan may be in the form of architectural drawings specifying every detail of the floor covering design, or it may be a simple, verbal description by the customer. When the floor layout is completed, the craftsman, assisted, when necessary, by an apprentice or other worker, cuts and fits the flooring material, applies the proper adhesive, and installs the floor covering. He must take care in cutting, matching, and fitting floor covering, particularly at door openings, along irregular wall surfaces, and around permanent floor fixtures, such as columns or piping. He must take special care also in cutting out and setting in decorative designs in the flooring. After the flooring is installed, the craftsman runs a floor roller over it to insure good adhesion to the subfloor.

The carpet craftsman, like the installer of resilient floor coverings, first inspects the floor to be covered to determine its condition. Then he plans his layout carefully to minimize waste of materials. He also allows for expected foot-traffic patterns so that best appearance and long wear will be obtained, and that carpet sections expected to receive heavy traffic can be replaced easily.

When installing the carpet, the craftsman may fasten "tackless strip," with adhesive or nails along the borders of the installation. (The strip secures the carpet when it is installed.) Instead of using this strip, the floor layer may use tacks to secure carpeting. Padding, which is placed under the carpet, is cut and placed within the framework of the strip and the carpet then placed approximately in position. If the carpet has not been precut and seamed by the floor covering firm, the installer will do this work before stretching the carpet into place. He then trims the edge of the carpet so that it will be held securely and smoothly by tacks or by nails protruding from the border strip. Finishing touches may include the use of a special roller to obscure seam markings that may result when carpet sections are joined.

Floor covering craftsmen generally specialize in installation of either carpet or resilient floor covering, although some mechanics can install both types. Some may specialize even further. For example, the most skilled installers generally install the more expensive carpeting, and the resilient sheet flooring with the most intricate designs. Many floor installers specialize also in the installation of resilient tile; others, resilient wall and counter coverings.

The tools used by floor covering installers include hammers; pry bars; knives, shears, and other cutting devices; measuring and marking tools, such as tape measures, compasses, straightedges, scribes, chalk, and chalklines; and a variety of specialized tools, such as notched adhesive trowels, carpet stretching devices, and floor rollers.

Places of Employment

Most floor covering installers are employed by flooring contractors who may specialize in commercial and industrial flooring work, in residential floor covering, or in specific types of installations such as resilient tile. Many others work for retailers of floor covering who also provide installation service. Floor covering installers also are employed by furniture and department stores that sell and install floor coverings, as well as by home alteration and repair contractors.

Heavy concentrations of these workers are found in large business centers where high levels of both commercial and residential building prevail.

Training, Other Qualifications, and Advancement

In considering applicants for floor covering installation jobs, employers are particularly interested in those having manual abilities. They prefer applicants with a high school education, but this qualification is not generally required. Most employers seek applicants between 17 and 30 years of age having at least average physical strength. A neat appearance and a pleasant business-like manner are important attributes because the work is performed on the customer's premises.

Training authorities generally recommend a 3- or 4-year apprenticeship program as the best way to learn the floor covering trade. Most apprenticeship programs include 6,000 hours (3 years) or 8,000 hours (4 years) of on-the-job training in addition to related classroom instruction. In these training programs, the trainee learns the techniques of floor covering installation and how to handle the tools of the trade. Through work assignments with skilled craftsmen on a wide variety of floor covering jobs, he learns to plan and execute different types of jobs in a minimum of time and with the most efficient and decorative use of materials. Most apprentices are required to attend class twice a week to learn about the nature of the materials they will be using, and the use and care of tools and equipment. They also study the mathematics of layout work, interpretation of architectural drawings, and planning and layout of floor covering installations.

Some apprenticeship programs may combine training in the installation of resilient floor and wall covering with training in the laying of carpets. Other programs may be limited to the installation of resilient coverings.

Many workers in this trade have acquired their skills through informal training methods, such as working as a trainee or laborer, and observing or being taught by experienced floor covering installers. Many of these men also have gained some knowledge of floor covering installation by attending trade school or manufacturers' training courses, and through home study.

Many informal training programs limit the trainee's work experience to installation of resilient tile, or to residential floor covering work of limited complexity. This lack of all-round experience, however, may be partially offset by trade school and home-study courses and manufacturers' training programs. A young man interested in becoming a floor covering installer should direct inquiries to several firms about their training programs before accepting employment as a trainee.

Skilled floor covering installers may advance to the position of foreman or installation manager for a large floor laying firm. Some become salesmen or estimators for floor covering firms. Floor covering installers having business ability may form their own firms and employ their own mechanics.

Employment Outlook

Employment of floor covering installers—estimated at about 40,000 in 1970—is expected to increase rapidly through the 1970's. Many additional job openings will arise from the need to replace experienced workers who transfer to other occupations, retire, or die. Retirements and deaths alone are expected to provide several hundred job openings annually through the 1970's.

The projected increase in employment of floor covering installers is expected mainly because of the anticipated expansion in construction activity. (See discussion, p. 375.) Moreover, the use of resilient floor coverings and wall-to-wall carpeting will become more widespread. More versatile materials and colorful patterns are expected to contribute to a growing demand for floor coverings. For example, epoxy materials, a relatively new floor covering material, is extremely durable and can be used in many ways—as a solid floor covering to be painted a variety of colors, or as an adhesive or base for laying resilient flooring.

The best job opportunities will be for floor installers having all-round training in the installation of resilient tile and sheet goods or carpeting.

Earnings and Working Conditions

No national wage data on floor covering installers are available. However, wage information from a limited number of firms indicates that, in 1970, most experienced floor layers were paid between $4.50 and $6.00 per hour, although wage rates for skilled workers ranged from about $3.50 an hour in some areas to more than $7.00 an hour in others. Wage rates for these workers may also vary within an area because of differences in level of skill or degree of work specialization. Starting wage rates for apprentices and other trainees usually are about half of the mechanic's rate.

Most floor covering craftsmen, including those under union-management agreements, are paid on an hourly basis. In some nonunion shops, part of the installer's pay may be in the form of bonuses for work performed within a specified time period. In others, installers receive a monthly salary or are paid on the basis of the number of square feet or square yards of floor covering they install.

Floor covering installers generally work regular daytime hours. Particular circumstances, however, such as installing a floor in a store, or office, may require work during evening hours or on weekends when stores and offices are not open for business.

Floor covering installation work is usually not affected by weather conditions, since it is performed indoors. During the winter months, most work is done in heated buildings. Job hazards are not numerous, but installers frequently experience knee injuries because they do much of their work while kneeling; back injuries occur occasionally as a result of twisting and lifting on the job. Most of these injuries can be avoided, however, if proper work procedures are followed. Generally, an installer is assisted by a helper in heavy lifting, and usually he has proper equipment available to move heavy objects.

Sources of Additional Information

For further information regarding floor covering apprenticeships or other work opportunities in this trade, inquiries should be directed to local flooring contractors or floor covering retailers; a local union of the United Brotherhood of Carpenters and Joiners of America (in Eastern States); a local union of the International Brotherhood of Painters, and Allied Trades (in Western States); or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about apprenticeship, the Manpower Development and Training Act, and other programs that provide training opportunities.

General information about the work of floor covering installers may be obtained from:

Carpet and Rug Institute, Empire State Bldg., New York, N.Y. 10001.

Asphalt and Vinyl Asbestos Tile Institute, 101 Park Ave., New York, N.Y. 10017.

GLAZIERS

(D.O.T. 865.781)

Nature of the Work

Glaziers engaged in construction work cut, fit, and install plate glass, ordinary window glass, mirrors, and special items such as leaded glass panels. When installing glass, the glazier cuts the glass to size or uses precut glass. The glazier puts a bed of putty into the wood or metal sash (frames) and presses the glass into place. He fastens the glass using wire clips or triangular metal points and then places and smoothes another strip of putty on the outside edges of the glass to keep out moisture.

When installing structural glass, which is used to decorate building fronts, walls, ceilings, and partitions, the glazier (and sometimes the marble setter, see discussion, p. 401) applies mastic cement to the supporting backing and presses the glass into it. The glass may have to be trimmed with a glass cutter if it is not precut to specifications. Glaziers generally install all types of structural glass, both interior and exterior, that is set or glazed with putty, moulding, rubber, and mastic. For example, they install shower doors and bathtub enclosures, mirrors of all types, and window glass. These craftsmen also set a wide variety of automatic doors, and fabricated units constructed of glass that are installed in many buildings.

In addition to handtools, such as glass cutters and putty knives, glaziers use power cutting tools and grinders.

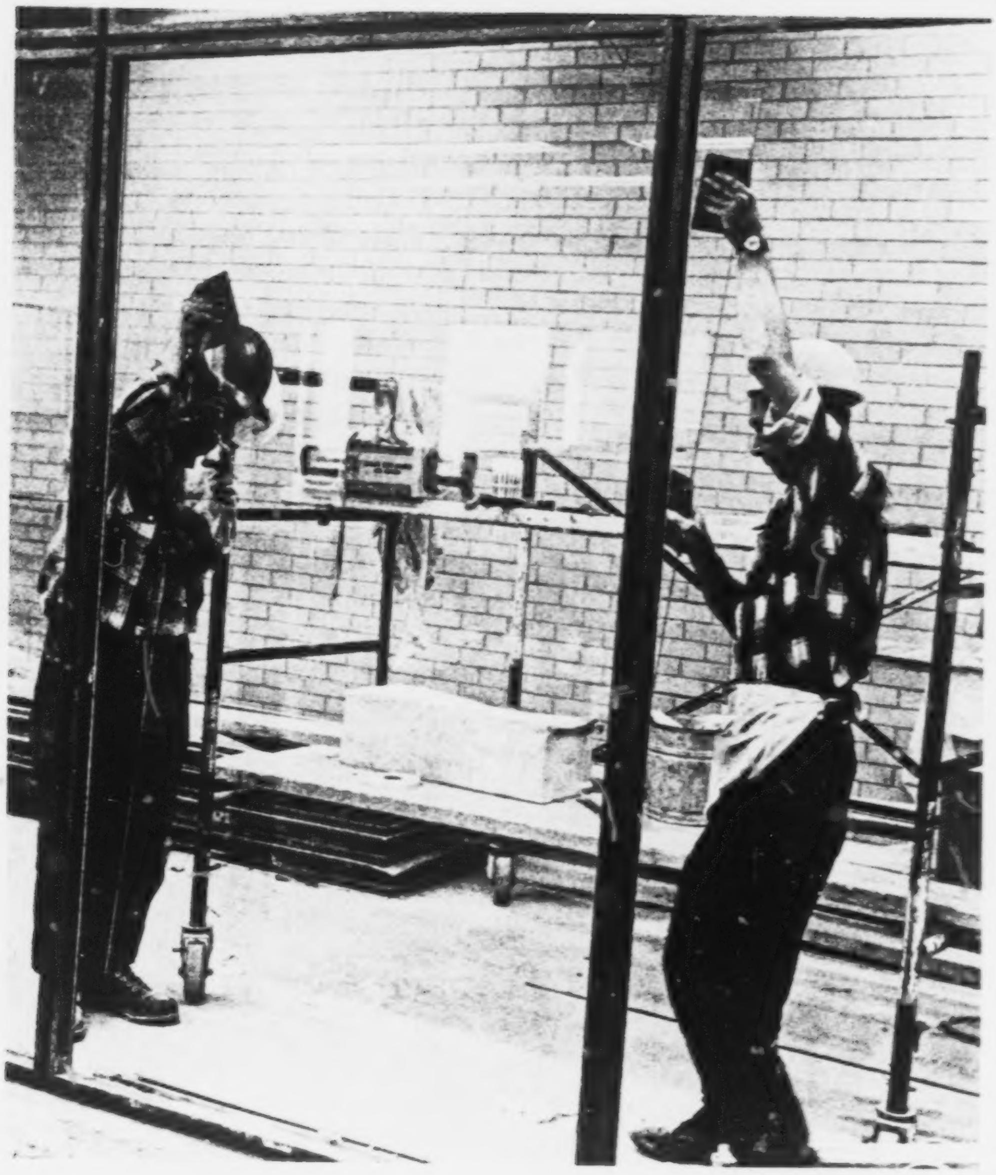
Places of Employment

Most of the estimated 10,500 construction glaziers employed in 1970 worked for glazing contractors engaged in new construction, alteration and modernization work, and on the replacement of broken glass, particularly for store windows. Some glaziers were employed by government agencies or business establishments which do their own construction work.

About 12,500 glaziers worked outside the construction industry. Many are employed in factories where they install glass in sash, doors, mirror frames, and partitions. Others, using skills similar to those used by glaziers, install glass or mirrors in furniture and ships or replace glass in automobiles.

Training and Other Qualifications

Most training authorities, including the National Joint (labor-management) Glazier and Glassworker



Apprenticeship Committee, recommend the completion of a 3-year apprenticeship program as the best way to learn the skills of the construction glazier. A substantial proportion of glaziers, however, have learned the trade informally. They have acquired their skills by working with experienced glaziers and observing or being taught by them. In smaller communities, many journeymen painters and paperhangers also have learned to do glazier work as part of the apprentice training for their trade.

Apprenticeship applicants generally are required to be at least 18 years of age, but they should not have reached their 26th birthday. Eligible veterans are exempt from the maximum age limit. A high school diploma or its equivalent is required.

The apprenticeship program usually consists of 6,000 hours (3 years) of on-the-job training, in addition to a minimum of 144 hours a year of related classroom instruction. During the apprenticeship, the trainee learns how to use and handle the tools, machines, and materials of the trade. Instruction is given in safety measures and first aid, and the reading of specifications and blueprints, and scaffolding. The program also includes on-the-job training in the glazing of wood and metal sash in doors, windows, partitions, and other openings; and the setting and replacement of all types of store front installations, structural glass, mirrors, showcases, partitions and fixtures, and automobile glass.

Hourly wage rates for glazier apprentices usually start at 50 percent of the journeyman rate and increase periodically until the journeyman rate is reached at the completion of training.

Employment Outlook

A rapid increase in employment of construction glaziers is expected through the 1970's. In addition to new jobs created by employment growth, many job opportunities will result from the replacement of construction glaziers who transfer to other fields of work, retire, or die.

The large increase anticipated in construction activity (see discussion, p. 375) and the increasing use of glass in building construction are expected to result in more work for construction glaziers. Replacement and modernization work, frequently involving large glass installations, also will contribute to the demand for these workers. The long-range outlook for this occupation generally can be considered very favorable.

Earnings and Working Conditions

Union minimum hourly wage rates for construction glaziers averaged $6.08, compared with $6.54 for all journeymen in the building trades, on July 1, 1970, according to a national survey of building trades workers in 68 large cities. Among individual cities surveyed, the union minimum hourly wage rate for construction glaziers ranged from $4.25 in Jackson, Miss., to $7.51 in Cleveland, Ohio. Straight-time hourly earnings, excluding fringe benefits or payments to health, insurance, or pension funds, for construction glaziers in 12 of the 68 cities selected to show wage rates from various regions and areas of the country, on July 1, 1970, appear in the accompanying tabulation.

City	*Rate per hour*
Albuquerque	$4.45
Atlanta	5.15
Baltimore	5.30
Dallas	5.25
Detroit	6.92
Kansas City	5.92
Los Angeles	7.03
Madison	5.20
Providence	5.42
San Diego	6.19
Spokane	5.34
Trenton	6.93

Glaziers are exposed to some hazards in their work, such as cuts from glass edges and sharp tools used in cutting glass, back injuries caused by lifting plate glass, and falls from scaffolding. However, employers and unions attempt to eliminate injuries by promoting safety training and procedures.

A large proportion of glaziers employed in construction work are members of the International Brotherhood of Painters and Allied Trades.

Sources of Additional Information

For further information regarding glazer apprenticeships or other work opportunities in this trade, inquiries should be directed to local glazing contractors or general contractors; a local of the International Brotherhood of Painters and Allied Trades; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other training opportunities.

General information about the work of glaziers may be obtained from the International Brotherhood of Painters and Allied Trades, 1925 K St. NW., Washington, D.C. 20006.

LATHERS

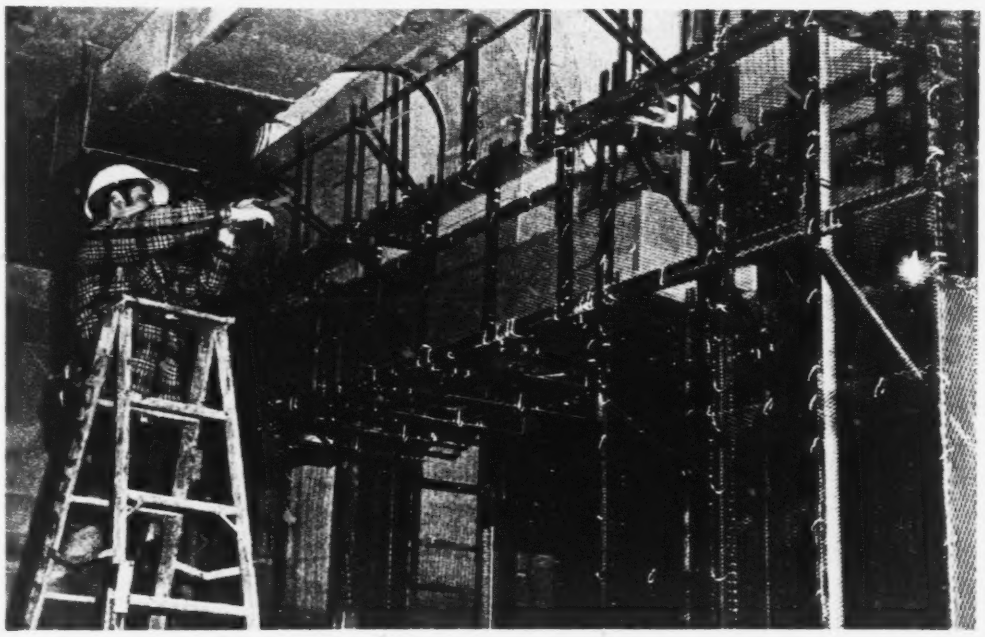
(D.O.T. 842.781)

Nature of the Work

Lathers install the support backings on which plaster, stucco, or concrete materials are applied. These supports are usually of two types—metal lath (strips of expanded metal or a metal wire mesh) or gypsum lath. The plaster easily adheres to either type of lath when mixed to the proper proportion and consistency.

When installing metal lath, the lathers first build a light metal framework (furring), which is fastened securely to the structural framework of the building. On ceilings or interior walls, the lath may be attached directly to the wood framework or partitions. Attachment to the furring or framework may be done by nailing, clipping, tying, or machine stapling. As the lath is being installed, the lathers cut openings for electrical outlets and piping.

Gypsum lath is installed in much the same way. These lath boards are usually 16 by 48 inches (⅜ inch thick) and cover three studs (upright 2 by 4 inches framework, placed 16 inches on center). The gypsum lath is cut by using a lath hatchet to score one side, and then easily broken with a sharp blow on the opposite side. Openings for electrical outlets and other openings must be cut before attaching the lath to the wall or ceiling.



Lathers also install wire mesh reinforcement in all inside angles and corners to prevent structural cracking. On outside or exposed corners, a metal reinforcement called a corner bead is attached as a guide for the plasterer. It provides protection and structural strength to the finished corner.

Lathers also install the metal studs and framework for metal interior partitions which receive lath and plaster or gypsum board. They erect the light iron furring which supports acoustical ceilings.

The method of installation varies slightly in other types of lath work. For example, when cornices or other ornamental plaster shapes are specified, the lather builds the framework that approximates the desired shape or form. Metal lath is then attached to the framework by the lather.

When stucco (a mixture of portland cement and sand) is to be applied over wood framework, the lather installs two layers of wire mesh, separated by a layer of felt, to act as a base.

The tools of the trade include measuring rules and tapes, drills, hammers, chisels, hacksaws, shears, wirecutters, boltcutters, punches, pliers, hatchets, stapling machines, and powder- or power-actuated fastening devices.

Places of Employment

Most lathers—who numbered about 30,000 in 1970—work for lathing and plastering contractors on new residential, commercial, or industrial construction. They also work on modernization and alteration jobs. Some lathers also are employed outside the construction industry; for example, they make the lath backing for plaster display materials or scenery.

Training, Other Qualifications, and Advancement

The National Joint (labor-management) Apprenticeship Committee for the Lathing Industry and many other training authorities recommend the completion of a minimum of 2 years of apprenticeship as the best way to learn lathing. However, many lathers, particularly in small communities, have acquired skills informally, by working as helpers, observing or being taught by experienced lathers.

Apprenticeship applicants generally are required to be between 16 and 26, and in good physical condition. Aptitude tests are often given to applicants to determine whether they have manual and finger dexterity, as well as the other qualifications required. Apprentices generally must pass examinations that are given at the end of each 6-month period.

During the apprenticeship period, the apprentice learns to use and handle the tools and materials of the trade. For example, he installs gypsum lath, wall furring, and metal lathing. In addition, he generally receives related instruction in subjects, such as applied mathematics, geometry, reading of blueprints and sketches, welding, estimating, and safety practices. Today, a high school education is encouraged, and education above grade school level, particularly courses in mathematics, is needed to understand the related instruction.

Hourly wage rates for lather apprentices usually start at 50 percent of the journeyman rate. The rate is increased periodically by 5 percent every third or fourth month until a rate of 85 percent is reached in the final quarter of the second year of training.

Skilled and experienced lathers may become foremen. Others may be able to start their own lath contracting business.

Employment Outlook

Employment of lathers is expected to increase rapidly through the 1970's. In addition to new jobs created by employment growth, many job opportunities will result from the replacement of experienced lathers who transfer to other fields of work, retire, or die. Retirements and deaths alone are expected to result in a few hundred job openings annually.

Growth of the trade depends principally upon the anticipated large increase in construction activity. (See discussion p. 375.) Moreover, there will be a growing need for lathing work because of the increasing use of new kinds of plaster and improved methods of applying plaster. Improved, lightweight plasters are being used increasingly because of their excellent fireproofing qualities and ease of handling. There is also a trend toward the greater use of curved surfaces and ceilings made of plaster, both as a form of architectural treatment and to achieve special lighting and acoustical effects. The use of "plaster veneer" as a surface finish is expected to expand because of time and cost economy. Machine plastering and fireproofing are growing in importance. Because these machines reduce the cost of plastering, their greater use should increase the demand for plaster work and for lathers. These developments are expected to more than offset the loss of lathing work resulting from the use of nonplaster (dry-wall) construction.

Earnings

Union minimum hourly wage rates for lathers averaged $6.44, compared with $6.54 for all journeymen in the building trades, on July 1, 1970, according to a national survey of building trades workers in 68 large cities. Among individual cities surveyed, the minimum hourly rates for lathers ranged from $4.45 in Tampa, Fla., to $8.56 in Cleveland, Ohio. Straight-time hourly earnings, excluding fringe benefits or payments to health, insurance or pension funds, for lathers in 12 of the 68 cities selected to present wage data from various areas and regions of the country, on July 1, 1970, appear in the accompanying tabulation.

City		*Rate per hour*
Boston		$6.50
Des Moines		5.78
Knoxville		4.90
Los Angeles	gypsum	6.74
	metal	6.22
Louisville		5.84
Newark		6.65
Peoria		6.58
Philadelphia		6.39
Rochester		7.23
Sacramento		6.45
Shreveport		5.38
Washington, D.C.		5.98

A large proportion of lathers are members of The Wood, Wire and Metal Lathers International Union.

Sources of Additional Information

For further information regarding lathers' apprenticeships or other work opportunities in the trade, a young man should apply to a lathing contractor in his area; a local of The Wood, Wire, and Metal Lathers International Union; a local joint labor-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of lathers may be obtained from:

Contracting Plasterers' and Lathers' International Association. 304 Landmark Bldg., 1343 H St. NW., Washington, D.C. 20005.

National Bureau for Lathing and Plastering, 938 K St. NW., Washington, D.C. 20001.

National Lathing Industries Joint Apprenticeship Program, 140 Main St., Annapolis, Md. 21401.

The Wood, Wire and Metal Lathers International Union, 6530 New Hampshire Ave., Takoma Park, Md. 20012.

MARBLE SETTERS, TILESETTERS, AND TERRAZZO WORKERS

(D.O.T. 861.381 and .781)

Nature of the Work

Marble setters, tilesetters, and terrazzo workers cover interior or exterior walls, floors, or other surfaces with marble, tile, or terrazzo. Craftsmen in each of these distinct trades work primarily with the material indicated by their job title.

Marble setters install marble, shop-made terrazzo panels and artificial marble, and structural glass in building interiors. The marble setter does little fabrication work because the marble and other materials are cut to size and polished before they are delivered to the worksite. However, he may do some minor cutting to make the materials fit exactly. In setting marble, he lays out the work, drills anchor holes in the marble for wall-work, fastens the nonferrous anchors to the marble, and then applies a special plaster mixture to the backing material and sets the marble pieces in place. When necessary, he braces the marble until the setting plaster has hardened. Special grout is packed into the joints between the marble pieces, and the joints are "pointed up" (slightly indented) with a pointing trowel or wooden paddle. Bolt holes have to be drilled if attachments to the marble are necessary, and for the installation of all marble toilet and shower compartments. The setting of marble on floors involves the preparation of the portland cement mortar, applying sufficient mortar for one piece of marble, and then placing the marble on the mortar and tamping it to the proper elevation. The craftsman then removes the marble piece, brushes or trowels a coat of neat cement to the back surface and, finally, resets the piece of marble on the setting bed and retamps it to the proper line and elevation. Each marble setter has a helper to prepare plaster, carry marble slabs, and clean the completed work.

The tilesetter attaches tile (a thin slab of baked clay, stone, or other material) on walls, floors, or ceilings according to blueprints or other instructions. For walls and ceilings, the tilesetter applies a setting bed to the surface or other support backing on which the tile is to be installed.

Marble setter applies mortar to terrazzo panel.

This setting bed consists of a coat of sand, cement, and a small amount of lime, plus a bond coat of pure portland cement mixed with water, or one of a number of patented portland cement mixtures. This bond coat is troweled directly on the mortar setting bed or is applied to the back of each individual tile immediately before the placement of the individual tiles to the setting bed. By using patented portland cement mixtures, one can wait for the setting bed to harden, and using the same procedure, set the tile on the hardened setting bed the following day or even the following week. Tiles are tapped into place on the setting bed with a trowel handle. In laying tile floors, the tilesetter applies the mortar setting bed on the floor, tamping the mortar firmly and screeding (leveling) the bed to the correct elevation. A bond coat of neat cement is then brushed or troweled to the setting bed or to the back of the tiles. The craftsman places the tile on the setting bed, and they are tapped firmly into the mortar. He chips the tile with a hammer and chisels or cuts it with pincers to make it fit into irregular areas, into corners, or around pipes.

Small tiles, such as those laid in bathrooms, are available on paper-backed strips and sheets that can be attached to the floor as a unit, using portland cement or various adhesives. This eliminates the setting of individual tiles. The tilesetter usually is assisted by a helper who mixes mortar, sets up scaffolds, supplies the setter with material, grouts (fills) the joints after the tile setting is completed, and cleans the completed work.

Terrazzo is a type of ornamental concrete used mainly for floors. Marble chips are used as the coarsest concrete ingredient. After the terrazzo hardens, it is ground and polished to give a smooth surface on which the marble chips are exposed against the background of the material in which the chips are mixed.

A terrazzo worker starts his work by laying a base of concrete mortar. He levels and tamps the concrete base with a long, flat tool called a straightedge. Then he places metal strips in the base wherever there is to be a joint or a change of color between panels or to create a pattern, and imbeds their bottom edges in the base. If there is to be lettering or an ornamental figure, he also imbeds a shopmade mold. Finally, he mixes the top course of cement and marble chips, pours it onto the base, and rolls and levels it. A separate mixture is made for each color. Where no concrete base is required, the craftsman mixes the marble chips with epoxy polyester resins, or latex, and this mixture is poured directly onto the floor. After the mixture has hardened for a few days, a terrazzo helper grinds and polishes the floor with an electric-powered grinding machine.

The terrazzo worker is assisted by helpers in the mixing and placing of the base course, but he alone does the leveling and placing of the metal strips. Helpers handle sand, cement, marble chips, and all other materials used by the terrazzo worker. They rub and clean marble, mosaic, and terrazzo floors and perform other work required in helping a terrazzo craftsman. The terrazzo worker generally supervises mixing of the top course that, along with the grinding, governs its final appearance.

Places of Employment

Marble setters, tilesetters, and

terrazzo workers are employed mainly in new building construction and in the large urban areas. Substantial numbers of terrazzo workers are employed in Florida and California.

Training, Other Qualifications, and Advancement

Most training authorities, including the national joint labor-management apprenticeship committees that set the training standards in these trades, recommend the completion of a 3-year apprenticeship program as the best way to learn each of these trades. A substantial proportion of tilesetters, terrazzo workers, and marble setters, however, have acquired their skills informally by working as helpers, observing, or being taught by experienced craftsmen.

Apprenticeship applicants generally are required to be between 17 and 22; a high school education or its equivalent is desirable. Good physical condition and manual dexterity are important assets. Applicants should have an eye for quickly determining proper alinements of tile, terrazzo, and marble, and have a good sense of color harmony.

The apprenticeship programs in each of these trades generally consist of 6,000 hours of on-the-job training, in addition to related classroom instruction. In a typical 3-year training program for terrazzo workers, apprentices learn, among other things, to use, care for, and handle safely the tools, equipment, and materials commonly used in the trade; mix, place, tamp, and level concrete and terrazzo material; and select, set, and level metal dividing strips. The apprentice also learns the selection and placement of materials according to the design of the job; the rough and final finishing of bases and covers; and hand and machine rubbing.

The apprentice receives related classroom instruction in blueprint reading, layout work, basic mathematics, and shop practice.

Hourly wage rates for apprentices in each of these trades start at about 50 or 60 percent of the journeyman rate and increase periodically until 95 percent of the journeyman rate is reached during the last period of apprentice training.

Skilled and experienced tile, terrazzo, or marble setters may become foremen. Others may be able to start their own small contracting businesses.

Employment Outlook

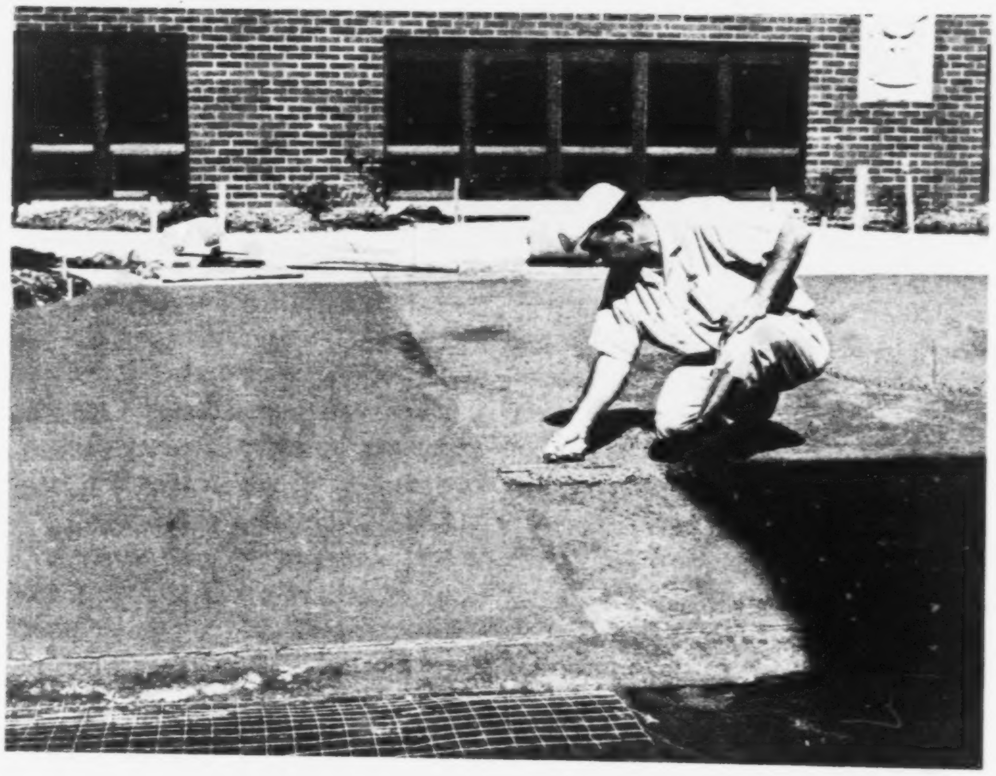
Combined employment estimated at about 30,000 in 1970 in the three trades—marble setter, tilesetter, and terrazzo worker—is expected to increase moderately through the 1970's. In addition, job opportunities will result from the need to replace experienced workers who transfer to other fields of work, retire, or die. However, employment growth and retirements and deaths will provide only several hundred job openings annually.

Total employment in these trades is expected to increase mainly because of the anticipated rapid expansion in construction activity. (See discussion, p. 375.) However, the rate of employment growth will vary sharply among these trades.

The demand for terrazzo workers is expected to increase rapidly. Because terrazzo is durable and attractive, the number of terrazzo installations is expected to continue to increase substantially. Growth of the trade also will be stimulated by the use of new terrazzo materials, especially epoxy and latex terrazzo. These products, which are lighter and occupy less space than cement-based terrazzo, are being used increasingly, especially on the upper floors of multistoried buildings. A small number of skilled terrazzo workers have been recruited from abroad to meet shortages of these workers in some areas.

A moderate increase is expected in the employment of tilesetters. Growth of this trade will be limited by the increasing use of competing materials, such as asphalt floor tile, structural glass, plastic tile, and plastic-coated wallboards, which usually are installed by workers other than tilesetters.

Little change in the employment of marble setters is expected. However, the excellent properties of marble as a building material will insure its continued use and provide work for marble setters, despite the relatively higher costs of marble compared with competitive materials.



Earnings and Working Conditions

Union minimum hourly wage rates for terrazzo workers averaged $6.46; for marble setters, $6.29; and for tilesetters $6.08; on July 1, 1970, according to a national survey of building trades workers in 68 large cities. These rates compared with the average of $6.54 for all journeymen in the building trades. Among the individual cities surveyed, the minimum hourly rates for terrazzo workers ranged from $4.50 in Norfolk, Va., to $8.09 in Cleveland, Ohio. For marble setters, the hourly rates ranged from $4.50 in Norfolk, Va., to $8.16 in Cleveland, Ohio. The rates for tilesetters ranged from $4.50 in Norfolk, Va., to $8.09 in Cleveland, Ohio. Straight time hourly earnings, excluding fringe benefits or payments to health, insurance, or pension funds, for marble setters, tilesetters, and terrazzo workers in 12 of the 68 cities selected to show wage rates from various areas and regions of the country, on July 1, 1970, appear in the accompanying tabulation.

	Rates per hour		
City	*Marble setters*	*Tile-setters*	*Terrazzo workers*
Atlanta	$5.20	$5.20	$5.20
Baltimore	6.60	5.39	5.39
Boston	6.40	6.75	6.40
Chicago	6.55	6.55	6.55
Dallas	5.25	5.60	5.60
Denver	5.55	5.55	5.55
Detroit	8.04	7.00	6.77
Little Rock	4.70	4.70	4.70
New Orleans	5.75	5.30	5.30
Sacramento	...	6.00	7.73
Spokane	6.16	5.81	6.00
Toledo	7.66	6.44	6.44

Marble setters and terrazzo workers work both indoors and outdoors, depending on the types of installation. Tilesetters work mostly indoors.

A large proportion of the workers in each of these trades are members of one of the following unions—Bricklayers, Masons and Plasterers' International Union of America; and International Association of Marble, Slate and Stone Polishers, Rubbers and Sawyers, Tile and Marble Setters' Helpers and Marble Mosaic and Terrazzo Workers' Helpers.

Sources of Additional Information

For further information regarding apprenticeship or other work opportunities in these trades, inquiries should be directed to local tile, terrazzo and marble setting contractors or to locals of the unions previously mentioned. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of marble setters, tilesetters, and terrazzo workers may be obtained from:

Bricklayers, Masons and Plasterers' International Union of America, 815 15th St. NW., Washington, D.C. 20005.

International Association of Marble, Slate and Stone Polishers, Rubbers and Sawyers, Tile and Marble Setters' Helpers and Marble Mosaic and Terrazzo Workers' Helpers, 821 15th St. NW., Washington, D.C. 20005.

National Terrazzo and Mosaic Association, Inc., 716 Church St., Alexandria, Va. 22314.

Tile Contractors' Association of America, Inc., 112 North Alfred St., Alexandria, Va. 22314.

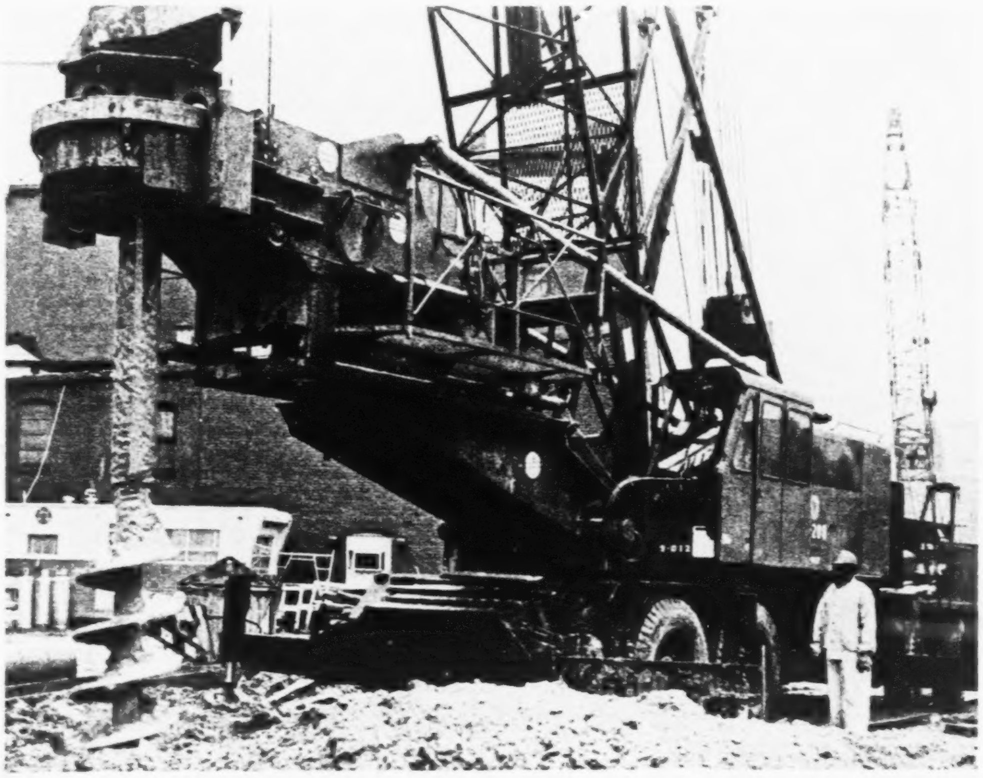
OPERATING ENGINEERS (CONSTRUCTION MACHINERY OPERATORS)

(D.O.T. 850.782 through .887; 851.883 and .887; 852.883; 853.782 and .883; 859.782; and 859.883)

Nature of the Work

Operating engineers operate and maintain various types of power-driven construction machinery. These machines include power shovels, cranes, derricks, hoists, pile drivers, concrete mixers, paving machines, trench excavators, bulldozers, tractors, and pumps. Operating engineers often are identified by the types of machines they operate; for example, craneman, bulldozer operator, derrick operator, or heavy equipment mechanic. These craftsmen have a wide range of skills, working with many different machines—some complex and others relatively simple. The range of skills may be described by discussing the duties of an engineer who operates a crane and one who operates an earth-boring machine.

The crane operator manipulates various pedals and levers to rotate the crane on its chassis and to raise and lower the crane boom and the loadline. The operator also manipulates a number of different attachments to the crane boom for various construction purposes. For example, he manipulates buckets for excavation work; pile drivers to drive steel beams, wood, and concrete piling into the ground; and wrecking balls for demolition work. Good eye-hand-foot coordination, precision handling of heavy equipment, and judgment in estimating proper load size are essential aptitudes for a crane operator. In contrast, earth-boring machines that dig holes for poles or posts require less skilled operators to set the proper auger (drill) in the spindle, start the machine, and stop the auger when it has penetrated to the correct depth.



Although skills vary, the trend is toward more versatility. An individual who desires steady employment, particularly in construction, should know how to operate several different types of equipment. Operators prefer to work on more complex machines because wage rates for operating such machines are higher.

Places of Employment

An estimated 310,000 operating engineers were employed as excavating, grading, and road machinery operators in 1970. In addition, thousands of operating engineers were employed for other types of construction machinery, including cranes, derricks, hoists, diesel engines, air-compressors, trench-pipe layers, and dredges.

Most operating engineers are employed by contractors engaged in highway, dam, airport, and other large-scale engineering projects. They are employed in excavating, grading, landscaping and in hoisting concrete, steel, and other building materials. Others are employed by utility companies, manufacturers, and other business firms that do their own construction work, as well as by State and local public works and highway departments. Relatively few operating engineers are self-employed. Those few are usually owner-operators of construction equipment, such as bulldozers, small cranes, and backhoes.

In addition to employment in construction work, operating engineers operate cranes, hoists, and other power-driven machinery in factories and mines. In some cases, the duties of operating engineers in nonconstruction jobs are about the same as those in construction work. For example, operation of a crane to unload cars of coal at a factory is very similar to operation of a crane to unload barges of sand and gravel for a street paving job. On the other hand, the work of a steel pourer (craneman) in a steel mill differs considerably from that of a crane operator in the construction industry.

Construction machinery operators are employed in every section of the country. Their work, however, may often take them to remote locations where highways and heavy engineering projects, such as dams are being built.

Training, Other Qualifications, and Advancement

Most training authorities, including the National Joint (labor-management) Apprenticeship and Training Committee for Operating Engineers, recommend completion of a 3-year apprenticeship as the best way to qualify for journeyman operating engineer. Apprenticeship standards provide training in the following equipment: (1) Universal equipment (hoists, shovels, cranes, and related equipment), (2) grading and paving equipment, and (3) plant equipment (such as material mixing and crushing machines). These standards also provide for training of heavy-duty construction machinery repairmen.

The apprenticeship program for each classification consists of at least 6,000 hours (3 years) of on-the-job training. Training is given by a lead engineer, a journeyman, or a master mechanic. In a typical universal equipment program, the apprentice learns to use, maintain, and handle safely the equipment and tools of the trade; set grade stakes; and read plans and instructions. He also learns the different types of greases and oils and to use welding and cutting equipment. In addition to on-the-job training, the program includes a minimum of 144 hours a year of related classroom instruction in subjects such as reading grade plans, elements of electricity, physics, welding, and automotive maintenance.

Apprenticeship applicants generally must be between 18 and 30; physically able to perform the work; have a high school education or its equivalent; and the ability and aptitude to master the trade.

Hourly wage rates for apprentices start at a stipulated proportion of the journeyman rate (at least 65 percent in most cases), and increase periodically until the journeyman rate is reached at the completion of the apprenticeship.

Many men having mechanical aptitude enter this occupation as oilers (operating engineer's assistants) or as helpers to heavy equipment repairmen. These workers learn to repair and maintain machinery. In time, they may receive operating instruction on the equipment from experienced operators.

Some men having mechanical experience, such as that obtained from operating farm equipment, may get jobs operating the simpler construction machines. The all-round knowledge necessary to obtain continuous employment is obtained best through a formal apprenticeship program.

Employment Outlook

Employment of construction machinery operators is expected to increase rapidly through the 1970's. Thousands of additional job opportunities will result from the replacement of experienced workers who transfer to other fields of work, retire, or die. Retirements and deaths alone are expected to provide a few thousand job openings annually.

The rapid rise in employment of operating engineers will occur mainly because of the anticipated growth in construction activity and the growing volume of highway construction resulting from the long-range multibillion dollar highway program (see discussion, p. 375). Job opportunities also will result

from the need to maintain and repair the highway system.

The increasing use of construction machinery shows every indication of continuing. More specialized machines, particularly earth-moving and smaller machines for small construction projects, are expected to be used. The increasing mechanization of materials movement in factories and mines also should result in growing employment of operating engineers outside of construction.

Technological improvements are expected to limit somewhat the growth in employment of construction machinery operators. For example, mobile truck cranes now can lift 125 tons to a height of 330 feet (equivalent to a 33-story building) and travel at speeds up to 35 m.p.h. Scrapers in use can scoop and carry from 75 to 150 tons of dirt in one load. Many types of laborsaving equipment, which combine the functions of several conventional machines, are expected to gain widespread use in the next decade. One example is the slipform paver that spreads, vibrates, forms, and finishes concrete paving in one continuous operation. Also, a pipelaying machine digs a trench, lowers the pipe into the trench, and fills the trench after the pipes are connected.

Electronic controls on construction equipment are being used increasingly. Electronic grade controls on highway paving equipment results in smoother pavements and greater efficiency.

Earnings and Working Conditions

Operating engineers have a more complicated wage structure than any other construction trade. Hourly rates are established for operators of machines of different types, for machines of the same type but different capacity, for the same machine in different types of construction, and for the same work in different parts of the country.

Crane operators, who generally are among the highest paid construction machinery operators, had union minimum hourly rates ranging from $4.70 in Birmingham, Ala., to $8.35 in Trenton, N.J., on July 1, 1970, according to a national survey of building trades workers in 68 large cities. The rates for bulldozer operators ranged from $3.90 in Norfolk and Richmond, Va., to $7.85 in Cleveland, Ohio. Straight-time hourly earnings, excluding fringe benefits or payments to health, insurance, or pension funds, for crane operators and bulldozer operators in 12 of the 68 cities selected to show wage rates from various areas and regions of the country, on July 1, 1970, appear in the accompanying tabulation.

City	*Rate per hour*	
	Crane operator	*Bulldozer operator*
Baltimore	$6.02	$5.22
Boston	6.94	6.82
Cincinnati	6.94	6.74
Denver	5.25	5.25
Erie	7.58	7.58
Houston	5.60	5.60
Los Angeles	6.91	6.91
Milwaukee	7.04	6.79
Omaha	6.13	5.78
Phoenix	6.74	6.50
San Diego	6.76	6.66
Tampa	6.06	4.85

The operating engineer works outdoors; consequently, he usually works steadily during the warmer months and experiences slow periods during the colder months. The operation of some machines, particularly bulldozers and some types of scrapers, is physically tiring because the constant movement of the machine shakes or jolts the operator.

A large proportion of operating engineers are members of the International Union of Operating Engineers.

Sources of Additional Information

For further information regarding operating engineer apprenticeships or work opportunities in this occupation, inquiries should be directed to local general contractors; a local of the International Union of Operating Engineers; a local joint apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of operating engineers may be obtained from:

Associated General Contractors of America, Inc., 1957 E St. NW., Washington, D.C. 20006.

International Union of Operating Engineers, 1125 17th St. NW., Washington, D.C. 20036.

PAINTERS AND PAPERHANGERS

(D.O.T. 840.131, .381, .781, .884, and .887 and 841.781)

Nature of the Work

Painting and paperhanging are separate, skilled building trades, although many craftsmen in these trades do both types of work. Both apply finishes to walls and other building surfaces. However, the materials they use, and the method of application, differ.

The painter applies coats of paint or other materials to either interior or exterior building surfaces (and other structures), for the purpose of decorating or protecting them. Other finishes can include varnish, stains, enamel, and lacquer. On the other hand, the paperhanger covers interior walls and ceilings of rooms with decorative wallpaper, fabric, vinyls, or other materials.

One of the primary duties of the painter—especially if he is repainting—is to prepare the surface to be painted. He must remove loose paint, either by scraping or by heating with a blowtorch and then scraping. He must also remove grease, fill nail holes and cracks, sandpaper rough spots, and brush off dust. Usually, in painting new surfaces, he must cover them with a prime coat or sealer to provide a suitable surface or base. He applies paint to many kinds of materials, including wood, structural steel, and clay products, generally by using a brush, spray gun, or roller.

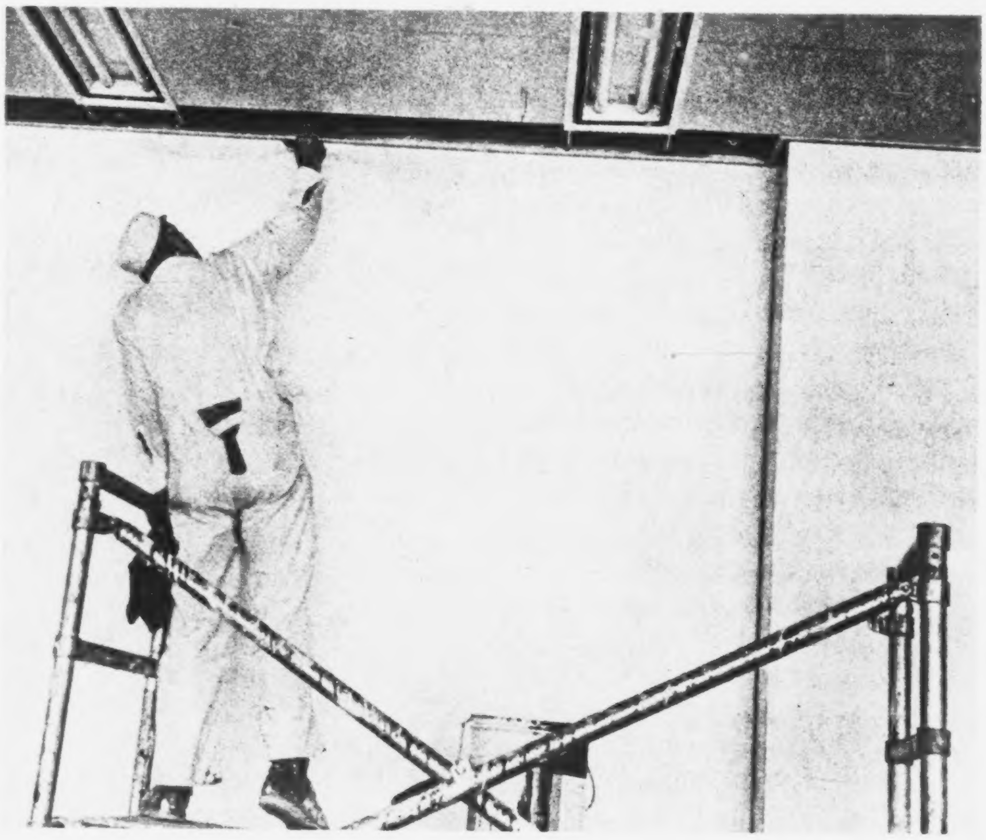
A painter must be skilled in handling brushes and other painting tools so that he can apply paint thoroughly, uniformly, and rapidly to any type of surface. He must be able to mix paints and match colors, using a knowledge of paint composition and color harmony. He also must know the characteristics of common types of paints and finishes from the standpoints of durability, suitability for different purposes, and ease of handling and application.

Painters often use spray guns to paint those surfaces or objects on which it is difficult to use a brush, such as lattices, cinder and concrete block, and metal fencing. They use them also on large areas that can be sprayed with a minimum of preparation. The painter also sometimes uses a roller (a rotating applicator covered with soft material), rolling the applicator over the surface to be covered.

Painters must know how to erect the scaffolding from which they often work, including "swing stages" (scaffolds suspended by ropes or cables attached to roof hooks) and "bosun chairs," which they use when working on tall buildings and other structures.

The paperhanger's first step is preparing the surface which he will cover. In undertaking new work, he applies "sizing," a prepared material that makes the plaster less porous and assures better sticking of the paper to the surface. In doing redecorating work, he may have to remove old paper by soaking or—if there are many layers—by steaming. Frequently, it is also necessary for paperhangers to do minor plaster patching in order to get a smooth base for the covering material

After he has prepared the wall, the paperhanger measures the area to be covered. He first cuts a length from the roll of wallpaper, and carefully positions the patterns so they will match at the ceiling and baseboard. He next mixes a paste and applies it to the reverse side of the paper. He then places the paste-coated paper strip on the wall, smoothing it into place with his hand and a dry brush. The paperhanger removes air bubbles by smoothing the paper strip toward the outer edges. In this final step, the craftsman matches the adjacent edges of the patterned paper, cuts and fits the horizontal edges at ceiling and base; smooths the seams between strips with a roller or other special tool; and makes a thorough inspection for air bubbles and other



imperfections in the work. Then he is ready to place the next wallpaper strip. When working with wall coverings other than paper, the paperhanger follows the same general procedure.

Places of Employment

Many painters and paperhangers work for contractors engaged in new construction. Substantial numbers of painters and paperhangers also are employed by contractors to do repair, alteration, or modernization work on existing structures. Hotels, office buildings, shipyards, utility companies, manufacturing firms, schools and other government units, and other organizations that own or manage extensive property holdings commonly employ maintenance painters. When interior redecorating involves wall papering, as in hotels or apartment buildings, maintenance painters also may do the required paperhanging.

Training, Other Qualifications, and Advancement

Most training authorities, including the National Joint (labor-management) Painting and Decorating Apprenticeship and Training Committee recommend the completion of a 3-year formal apprenticeship as the best way to become a journeyman painter or paperhanger. A substantial proportion of painters and paperhangers, however, have learned the trade informally, working as helpers or handymen to experienced craftsmen or by observing them or being taught by them. Workers without formal apprentice training have gained acceptance as journeymen more easily in these crafts than in most of the other building trades.

Apprentice applicants generally are required to be between 16 and 25 and in good physical condition. A high school education is preferred, although not essential. Applicants should have manual dexterity and a discerning color sense. They should not be allergic to paint fumes or to the other materials used in these trades, such as varnish, turpentine, and lacquer.

The apprenticeship for painters and paperhangers generally consists of 6,000 hours (3 years) of on-the-job training, in addition to 144 hours a year of related classroom instruction. Many apprenticeships combine painting and paperhanging. In a typical 3-year training program, the apprentice learns, among other things, to use, care for, and handle safely the tools, machines, equipment, and materials commonly used in the trade. He must also learn how to prepare surfaces (including sizing, sandpapering, and patching walls); match and mix colors; and apply various types of interior and exterior materials (including stain, lacquer, enamel, oil, and varnish). He must also learn how to erect scaffolding.

In addition, the apprentice receives related classroom instruction in such diverse subjects as color harmony; paint chemistry; estimating costs; and making, mixing, and matching paints. He also learns the relationship between painting and paperhanging and the work performed by the other building trades craftsmen.

Hourly wage rates for apprentices usually start at 50 percent of the journeyman rate and increase periodically until the journeyman rate of pay is reached upon completion of apprenticeship.

Painters and paperhangers may advance to foreman. They also may advance to jobs as estimators for painting and decorating contractors —computing material requirements and labor costs. Some may become superintendents on large contract painting jobs, or they may establish their own businesses as painting and decorating contractors.

Employment Outlook

Employment of painters—estimated at about 385,000 in 1970—is expected to increase rapidly through the 1970's. In addition to employment growth, thousands of job openings will arise from the replacement of experienced painters who transfer to other occupations, retire, or die. Retirements and deaths alone are expected to provide more than 10,000 job openings annually.

The large rise anticipated in construction activity (see discussion, p. 375) is expected to result in a growing demand for painters. Moreover, recently developed paints, such as polyester and vinyl coatings and epoxys, that are heat-, abrasion-, and corrosion-resisting have resulted in new uses for paints and additional job opportunities for painters. Furthermore, a growing number of painters are expected to be needed in the maintenance departments of large industrial and commercial firms.

Technological developments are expected to limit the growth of employment among painters. New types of paint that are more easily applied and have improved "covering power" have made it easier for inexperienced workers to do work that is acceptable to some customers. Other paints now being introduced promise to lengthen the "life" of present-day paints. Spray painting requires fewer painters to do the same amount of work. In addition, many items formerly painted at the building site now come from a factory with a prime coat and often with a final coat. Aluminum building products, which often require no painting, have been used increasingly in recent years.

Employment of paperhangers—estimated at about 5,000 in 1970—is expected to increase by a few thousand through the 1970's. In addition, some job openings will result from the replacement of experienced paperhangers who transfer to other occupations, retire, or die. Retirements and deaths alone are expected to result in a few hundred job openings annually.

Growth in the employment of paperhangers is expected to result mainly from the anticipated increase in construction activity. Also, more widespread use of fabric, plastic, and other types of wall covering applied by paperhangers should contribute to the demand for these workers. On the other hand, the use of paints for interior walls, as well as wallpapers designed for easier application by "do-it-yourselfers," will tend to limit the employment growth of paperhangers.

Earnings and Working Conditions

Union minimum hourly wage rates for painters and paperhangers in 68 large cities averaged $5.95 and $6.02, respectively, on July 1, 1970, according to a national survey of building trades workers. In comparison, the average rate for all journeymen in the building trades was $6.54 an hour. Among individual cities surveyed the minimum hourly rates for painters ranged from $3.65 in Richmond, Va., to $7.06 in Cleveland, Ohio. The rates for paperhangers ranged from $3.65 in Richmond, Va., to $7.09 in Dayton, Ohio. Straight-time hourly earnings, excluding fringe benefits or payments to health, insurance or pension funds, for painters and paperhangers in 12 of the 68 cities selected to show wage rates from various areas and regions of the country, on July 1, 1970, appear in the accompanying tabulation.

City	*Rate per hour*	
	Painters	*Paperhangers*
Atlanta	$5.95	$6.20
Boston	6.08	...
Chicago	6.35	6.35
Cincinnati	6.23	6.83
Detroit	7.00	7.00
Houston	5.34	5.44
Newark	6.00	...
New Orleans	4.38	4.38
Philadelphia	5.22	5.34
Salt Lake City	4.87	5.07
San Diego	6.49	6.99
Spokane	6.17	6.17

Their work often requires painters and paperhangers to stand for long periods of time, to climb, and to bend. A painter must have strong arms because much of the work is done with arms raised overhead. Painters and paperhangers risk injury from slips or falls from ladders and scaffolds.

A large proportion of painters and paperhangers are members of the International Brotherhood of Painters and Allied Trades. A few are members of other unions.

Sources of Additional Information

For further information regarding painting and paperhanging apprenticeships or other work opportunities in these trades, inquiries should be directed to local painting and decorating contractors; a local of the International Brotherhood of Painters and Allied Trades; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of painters and paperhangers may be obtained from:

International Brotherhood of Painters and Allied Trades, 1925 K St. NW., Washington, D.C. 20006.

Painting and Decorating Contractors Association of America, 2625 West Peterson Ave., Chicago, Ill. 60605.

PLASTERERS

(D.O.T. 842.381 and .781)

Nature of the Work

The plasterer is the building craftsman who applies a plaster coating to interior walls and ceilings to form fire-resistant and relative sound-proof surfaces, which then may be decorated with paint or wallpaper covering. They also apply more durable cement plaster or stucco to exterior walls, and form and cast ornamental designs in plaster.

In interior work, the plasterer usually applies three distinct coats of plaster—scratch, brown, and finish, to ceilings and walls. On wire or metal lath (backing to which plaster readily adheres), he applies the initial or scratch coat directly, then scratching it with a special raking tool before it "sets" (hardens). He then allows it to set a day or more before applying the brown coat, or second layer of plaster. On gypsum lath or masonry walls, he may use the same procedure; however, the brown coat can usually be applied immediately after the scratch coat has been completed.

The plasterer uses a hawk (a square plate of lightweight metal with a handle, about 14 by 14 inches), which holds several trowelfuls of material, and a trowel to apply the wet material. While applying the brown coat, the plasterer plumbs and straightens corners, angles, and wall and ceiling surfaces, using a straightedge, rod, or beveledge. The craftsman then uses a darby (a wood or metal float with handles, about 4 by 42 inches) to bring the main body of the walls and ceiling to a smooth and uniform finish. The brown coat is allowed to start its initial set and is then floated (rubbed lightly using a circular motion) using a wood hand float with slightly protruding nails. The nails scratch the undercoat which, in turn leaves the undercoat coarse and provides greater adhesion for the final finish coat.

Before applying the finish, or white coat, the craftsman must allow the brown coat to dry for several days. During cold weather, use of heat may be necessary to prevent the freezing and failure of materials, and to aid the plaster in drying. When the plasterer considers the brown-coated walls ready for the final coat, he mixes the white coat on a plaster board. He mixes only enough material, however, to cover an area to which he can apply a proper finish. The "white coat" is a relatively thin covering, which the craftsman must apply carefully and quickly, and finish smoothly with a trowel, brush, and water before the mixture has time to set. This covering sets very quickly, and in a few days dries to a very durable and hard finish.

The craftsman may finish wall surfaces in a number of ways by using different tools, methods, or materials. In place of a white coat as described above, he may use a variety of decorative textures, such as stipple (dots), swirl, and sand finishes, or colored interior stucco finishes.

A plasterer may perform more complex types of plastering work, such as decorative and ornamental plastering. For example, he may be called upon to mold or form intricate ornamental designs such as cornices, paneling, or recesses for indirect lighting. Plasterers who do this type of work must be able to follow blueprints and other specifications furnished by the architect.

In exterior stucco work, the plasterer applies a mixture of portland cement and sand to masonry, expanded metal, or metal wire lath in the same manner as he would in plastering interior surfaces. The finish coat usually consists of either a mixture of white cement and sand or a patented finish material, which may both be applied in a variety of colors and textures. Also, marble or gravel chips may be imbedded into the soft plaster to form a textured surface.

Apprentice plasterers work with journeymen so that they may acquire a full knowledge of the craft and develop the necessary skills. Laborers (hod carriers) also work with plasterers, mixing base coat materials and some finish materials, and carrying them to the plasterer. They also erect scaffolding when needed.

In recent years, plasterers have been making increasing use of machines that spray plaster on walls, ceilings, and structural sections of buildings. These machines are particularly desirable when used to apply the newly developed lightweight plasters. Machines used to mix plaster have been in general use for many years.

Places of Employment

Most plasterers work on new construction. In addition, these craftsmen work on extensive building alterations, particularly where special architectural and lighting effects are part of the building modernization. Some work for plasterers is found in the repair and maintenance of older buildings.

Training, Other Qualifications, and Advancement

Most training authorities, including the National Plastering Industry Joint (labor-management) Apprenticeship and Training Committee, recommend completion of a 3- or 4-year apprenticeship as the best way to learn plastering. However, many workers in this trade have acquired some plastering skills by working as helpers or laborers, observing or being taught by experienced plasterers.

Apprentice applicants in this trade generally are required to be between 17 and 25, but this requirement may be waived for veterans. Good physical condition and manual dexterity are important assets.

Apprenticeship programs generally consist of 6,000 to 8,000 hours (3 or 4 years) of on-the-job training, in addition to at least 144 hours of related classroom instruction annually. In a typical 4-year training program, the apprentice learns, among other things, to use and handle the tools of the trade, and the properties and appropriate handling of the different kinds of materials and mixtures used in plastering. In addition, he learns how to apply scratch (first) coat and brown (second) coat; aline walls and beams to given measurements; apply white coat and sand finish; install acoustical plaster and stucco, and acoustical tile, cork, and similar materials; use machines to apply and finish plaster; and lay out arches and ceilings. He also learns texture finishing.

The apprentice receives classroom instruction in such subjects as drafting, blueprint reading, and mathematics applicable to layout work. In the classroom and on the job, the apprentice becomes familiar with the work of other trades so that he may determine, for example, whether lathing, or other preparatory work is satisfactory.

Plasterers may advance to foreman, superintendent, or estimator for a plastering contractor. Many plasterers are self-employed and they may employ other plasterers.

Employment Outlook

A slow increase in the employment of plasterers—estimated at about 35,000 in 1970— is expected during the 1970's. In addition, replacement of experienced plasterers who transfer to other fields of work or who retire or die will provide many job openings for new workers. Retirements and deaths alone are expected to result in several hundred job openings annually.

The growth in employment of these workers will result primarily from anticipated large increases in construction activity. (See discussion, p. 375.) In addition, recent changes in plastering materials and improvement in methods of applying these materials are creating work opportunities for plasterers by increasing the scope of the craft. For example, improved lightweight plasters are being used increasingly because of their excellent soundproofing and fireproofing qualities. Also, expanding job opportunities for plasterers is the growing use of curved surfaces and ceilings made of plaster, both to achieve a form of architectural treatment and also special lighting and acoustical effects. Plastering and fireproofing by machine have been widespread. Still other developments are the increasing use of "plaster veneer" or "high density" plaster, a thin, extremely hard material used to create a finished surface, and "marblecrete," a type of stucco in which varicolored marble chips have been imbedded.

However, the growth in employment resulting from these favorable developments will be countered by the continuing use of nonplaster (dry-wall) construction, installed by craftsmen other than plasterers.

Earnings and Working Conditions

Union minimum hourly rates for plasterers averaged $6.35, compared with $6.54 for all journeymen in the building trades, on July 1, 1970, according to a national survey of building trades workers in 68 cities. Among individual cities surveyed, the minimum hourly rates for plasterers ranged from $4.25 in Charlotte, N.C., to $8.56 in Cleveland, Ohio. Straight-time hourly earnings, excluding fringe benefits or payments to health, insurance, or pension funds, for plasterers in 12 of the 68 cities selected to show wage rates from various areas and regions of the country, on July 1, 1970, appear in the accompanying tabulation.

City	*Rate per hour*
Birmingham	$4.82
Chicago	7.00
Dayton	6.95
Detroit	6.84
Grand Rapids	6.77
Little Rock	5.04
Madison	6.20
New Haven	6.55
New Orleans	5.20
Philadelphia	6.19
Sacramento	6.30
Spokane	6.49

Plastering requires considerable standing, stooping, and lifting. Plasterers work both outdoors doing stucco work, and indoors plastering walls and ceilings and forming and casting ornamental designs.

A large proportion of plasterers are members of unions. They are represented by either the Operative Plasterers' and Cement Masons' International Association of the United States and Canada, or the Bricklayers, Masons and Plasterers' International Union of America.

Sources of Additional Information

For further information regarding plastering apprenticeships or other work opportunities in the trade, inquiries should be directed to local plastering contractors; locals of the unions previously mentioned; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of plasterers may be obtained from:

Bricklayers, Masons and Plasterers' International Union of America, 815 15th St. NW., Washington, D.C. 20005.

International Association of Wall and Ceiling Contractors, 20 E St. NW., Washington, D.C. 20001.

National Bureau for Lathing and Plastering, 938 K St. NW., Washington, D.C. 20001.

Operative Plasterers' and Cement Masons' International Association of the United States and Canada, 1125 17th St. NW., Washington, D.C. 20036.

PLUMBERS AND PIPEFITTERS

(D.O.T. 862.381)

Nature of the Work

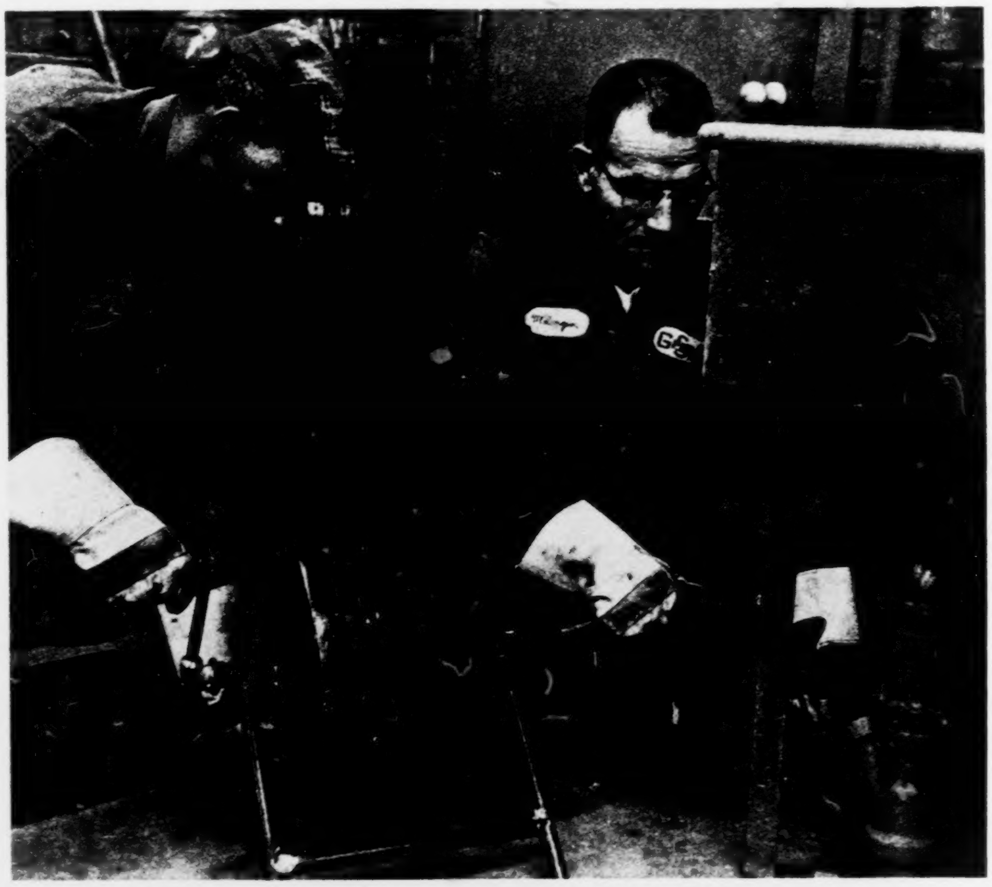
Plumbers and pipefitters are craftsmen who install pipe systems that carry water, steam, air, or other liquids or gases needed for sanitation, industrial production, or other uses. They also alter and repair existing pipe systems and install plumbing fixtures, appliances, and heating and refrigerating units.

Although plumbing and pipefitting are sometimes considered to be a single trade, journeymen can specialize in either craft, particularly in large cities. Water, gas, and waste disposal systems, especially those connected to public utility systems, are installed by plumbers. These installations are made in residential and commercial buildings, schools, industrial plants, and other structures. In homes, for example, plumbers initially "rough in" (install) the pipe system as the building progresses. During the final construction stages, they install the heating and air conditioning units, and connect radiators, water heaters, and plumbing fixtures, such as bathtubs and sinks.

Pipefitters install both high- and low-pressure pipes that carry hot water, steam, and other liquids and gases, especially those in industrial and commercial buildings and defense establishments such as missile launching and testing sites. Pipefitters, for example, install ammonia-carrying pipelines in refrigeration plants, complex pipe systems in oil refineries and chemical and food-processing plants, and pipelines for carrying compressed air and industrial gases in many types of industrial establishments.

Some plumbers and pipefitters specialize in gas fitting, steam fitting, or sprinkler fitting. Gas fitters install and maintain the gas fittings and the central gas main extensions that connect the main gas line with those leading to homes. Steamfitters assemble and install steam or hot water systems for commercial and industrial uses. Sprinkler fitters install and maintain all types of fixed piping fire extinguishing systems.

Plumbers and pipefitters use a



Plumbers use auger to clean waste line.

variety of skills when installing pipe systems. For example, they bend pipe and weld, braze, calk, solder, or thread joints. After a pipe system is installed, the plumber or pipefitter tests for leaks by filling the pipes with liquid or gas under pressure.

Plumbers and pipefitters use wrenches, reamers, drills, braces and bits, hammers, chisels, saws, and other handtools. Power machines often are used to cut, bend, and thread pipes. Hand-operated hydraulic pipe benders are also used. In addition, plumbers and pipefitters use gas or acetylene torches and welding, soldering, and brazing equipment in their work.

Places of Employment

Most plumbers and pipefitters are employed by plumbing and pipefitting contractors in new construction activity, mainly at the construction site. A substantial proportion of plumbers are self-employed or work for plumbing contractors doing repair, alteration, or modernization work. Some plumbers install and maintain pipe systems for government agencies and public utilities, and some work on the construction of ships and aircraft. Others do maintenance work in industrial and commercial establishments. Pipefitters, in particular, are employed as maintenance personnel in the petroleum, chemical, and food-processing industries where the industrial operations include the processing of fluids through pipes.

Training, Other Qualifications, and Advancement

Most training authorities, including the national joint labor-management apprenticeship committees for the plumbing and pipefitting industries, recommend a formal 5-year apprenticeship for plumbers or for pipefitters as the best way to learn all aspects of these trades. A large number of plumbers and pipefitters, however, have acquired plumbing and pipefitting skills informally by working for several years with craftsmen, and by observing and receiving instruction from them. Many of these persons have gained some knowledge of their trade by taking trade or correspondence school courses.

Apprentice applicants generally are required to be between 16 and 25, and in good physical condition. A high school education or its equivalent, including courses in mathematics, physics, and chemistry, is generally recommended. Applicants often are required to take aptitude tests, particularly to determine whether they have the high degree of mechanical aptitude required in this field.

Most apprentice training programs for plumbers and pipefitters are conducted under written agreements between the apprentices and local joint apprenticeship committees, composed of union and management representatives, who supervise the training. The apprenticeship committee determines the need for apprentices in the locality, establishes minimum apprenticeship standards of training and, if necessary, schedules a rotating work program. This program is designed to give the apprentice diversified training by having him work for several plumbing or pipefitting contractors.

The apprenticeship program for plumbers or for pipefitters usually consists of 10,000 hours of on-the-job training, in addition to at least 144 hours of related classroom instruction annually. In a typical 5-year training program, the plumber or pipefitter apprentice learns, among other things, how to use, care for, and handle safely the tools, machines, equipment, and materials used in the trades. They also learn welding and soldering techniques

and general repair work; the use of ladders and the erection and dismantling of scaffolding; and the proper use of plastic and glass piping. The plumber apprenticeship program includes training in the basic skills of the trade and in the installation of sewers, drains, and services outside the building; private water supply and drainage systems; building water supply systems; building drainage and vent systems; water heaters and treatment equipment; appliances; the testing, repair, and maintenance of these systems and equipment; and also in estimating the materials required. The pipefitter apprenticeship program includes training in the installation and maintenance of radiators, pumps, boilers, stokers, oil burners, and gas furnaces; hot water, steam panel, and radiant-heating systems; air-conditioning and powerplant piping systems; and pneumatic control systems and instrumentation.

The apprentice receives related classroom instruction in subjects such as drafting and blueprint reading, mathematics applicable to layout work, applied physics and chemistry, and local building codes and regulations that apply to the trade.

Hourly wage rates of apprentices in these trades usually start at 40–50 percent of the journeyman rate and increase in each 6-month period until a rate of 85–90 percent is reached during the last period of the apprenticeship.

To obtain a journeyman's license which some communities require, a person must pass a special examination to demonstrate knowledge of the trade and of the local building codes.

Some journeymen plumbers and pipefitters may become foremen for plumbing or pipefitting contractors. Many journeymen go into business for themselves. As they expand their activities, they may employ other workers and become plumbing and pipefitting contractors. In most localities, contractors are required to obtain a master plumber's license.

Employment Outlook

Employment of plumbers and pipefitters—who numbered about 350,000 in 1970—is expected to rise rapidly through the 1970's. In addition to new jobs created by employment growth, thousands of job opportunities will arise to replace experienced plumbers and pipefitters who transfer to other fields of work, retire, or die. Retirements and deaths alone are expected to result in several thousand job openings annually.

The most important factor that will contribute to the projected rise in employment is the anticipated large increase in construction activity. (See discussion, p. 375.) Furthermore, plumbing and heating work is expected to become more important in many types of construction. For example, the trend toward more bathrooms per dwelling unit is likely to continue. The installation of appliances, such as washing machines for clothes or dishes, gas dryers, and waste disposals, also will continue. The number of automatic heating system installations probably will increase. Also, in industry generally, plumbers and pipefitters will be required for necessary installation and maintenance work. For example, the chemical industry, which uses extensive pipework in its processing activities, is expected to expand its facilities. Those industries that are automating more of their production activities will require more pipefitting work. The increasing industrial activities related to nuclear energy and the greater use of refrigeration and air-conditioning equipment also will result in more work for plumbers and pipefitters. Finally, maintenance and repair, and modernization of existing plumbing or heating systems will create additional employment opportunities for these craftsmen.

Technological developments are expected to limit the growth in the number of jobs for plumbers and pipefitters. For example, prefabricated plumbing assemblies can now be installed as a unit, reducing the amount of on-site plumbing required. Packaged gas vents also are available. Ventpipe sections come in standardized lengths that can be fastened together by locking joint bands, thus eliminating cementing operations. Some builders are preassembling their own waste, vent, and other systems components. This work—usually performed by the employers' regular crew in well-equipped shops set up near the building site—can be performed during inclement weather or other "slow" periods.

Earnings and Working Conditions

Union minimum hourly wage rates for plumbers and for pipefitters averaged $7.01 and $6.93, respectively, on July 1, 1970, according to a national survey of building trades workers in 68 large cities. At the same time, the average hourly rate for all journeymen in the building trades was $6.54. Among individual cities surveyed, the union minimum hourly wage rates for plumbers ranged from $5.00 in Norfolk, Va., to $9.42 in Oakland, Calif.; pipefitters' rates ranged from $5.00 in Norfolk, Va., to $9.42 in Oakland, Calif. Straight-time hourly earnings, excluding fringe benefits or payments to health, insurance, or pension funds, for plumbers and pipefitters in 12 of the 68 cities selected to show wage information from various areas and regions of the country, on July 1, 1970, appear in the accompanying tabulation. Annual earnings of workers in this field are among the highest in the building trades because plumbing and pipefitting are affected less by seasonal factors than are most other building crafts.

City	*Rate per hour*	
	Plumbers	*Pipefitters*
Atlanta	$6.85	$6.85
Boston	6.70	6.60
Columbus	8.63	8.63
Dallas	6.21	6.21
Kansas City	7.60	7.42
Memphis	6.44	6.40
Newark	7.25	7.45
Phoenix	6.70	6.70
Pittsburgh	6.81	6.44
Sacramento	7.33	7.33
Shreveport	6.09	6.09
Tulsa	6.21	6.16

The work of plumbers and pipefitters is active and sometimes strenuous, as in other building trades. They frequently must stand for prolonged periods and occasionally work in cramped or uncomfortable positions.

Workers in this trade risk the danger of falls from ladders, cuts from sharp tools, and burns from hot pipes or steam. The number of injuries per million man-hours worked by employees of plumbing, heating, and air-conditioning contractors in the contract construction industry has been lower than that for contract construction as a whole, but higher than the average for production workers in manufacturing industries.

A large proportion of plumbers and pipefitters are members of the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada.

Sources of Additional Information

For further information regarding plumber or pipefitter apprenticeships or work opportunities in these trades, inquiries should be directed to local plumbing, heating, and air-conditioning contractors; a local union of the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities. Some local employment service offices provide such services as screening applicants and giving aptitude tests.

General information about the work of plumbers, pipefitters, and sprinkler fitters may be obtained from:

National Association of Plumbing-Heating-Cooling Contractors, 1016 20th St. NW., Washington, D.C. 20036.

National Automatic Sprinkler and Fire Control Association, 277 Park Ave., New York, N.Y. 10007.

United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada, 901 Massachusetts Ave. NW., Washington, D.C. 20001.

ROOFERS

(D.O.T. 804.281; 843.844; and 866.381)

Nature of the Work

Roofers apply composition roofing and other materials, such as tile and slate, to the roofs of buildings. They also waterproof and dampproof walls and other building surfaces.

In applying composition roofing, the roofer first places over-lapping strips of asphalt or tar impregnated felt over the entire surface. He then applies a coating of coal tar pitch, asphalt, or other bituminous material. This process is repeated until at least three layers of felt are in place. Finally, he applies a surfacing of coal tar pitch, or asphalt and gravel, or a smooth surface asphalt to protect the roofing materials from the weather.

Other types of composition roofing, such as roll roofing and asphalt shingles, overlap and are fastened to the roof base with nails or asphalt cement. If necessary, material is cut to fit corners, pipes, and chimneys. Wherever two roof surfaces intersect, the roofer cements or nails flashing (strips of felt or metal) to make the intersections (joints) watertight.

Roofers also use metal, tile, and slate for the more expensive types of roofs. Metal roofs are constructed by soldering metal sheets together and nailing them to the wood sheathing. In installing tile and slate roofs, the roofer places a covering of roofing felt over the wood sheathing. He punches holes in the slate or tile that he nails to the sheathing. Each row of slate or tile overlaps the preceding row. Finally, the roofer covers the exposed nailheads with roofing cement to

Roofers apply tar prior to spreading gravel.

avoid rusting and water leakage around the nailheads. Handtools usually are used in applying roof surfaces—for example, hammers, roofing knives, mops, pincers, and calking guns.

Roofers also waterproof and dampproof structures other than roofs, such as masonry, concrete walls, or swimming pools and other tanks. The roofer prepares surfaces to be waterproofed by removing rough projections and roughing glazed surfaces, using a hammer and chisel or rubbing brick. He then applies a coat of liquid compound with a brush. He also may paint or spray surfaces with a waterproofing material or nail waterproofing fabric to surfaces. When dampproofing, he usually sprays a coating of tar or asphalt on interior or exterior surfaces to avoid the penetration of moisture.

Places of Employment

Roofers work for roofing contractors on new building construction. They also do maintenance and repair work, especially on composition roofing. A few roofers are self-employed, doing either roofing on small, new buildings or repairs and alterations. Roofers also work for government agencies or business establishments that do their own construction and repair work.

Training, Other Qualifications, and Advancement

Most training authorities, including the National Joint (labor-management) Apprenticeship and Training Committee for the Roofing Industry, recommend completion of a 3-year apprenticeship program, covering all types of roofing work, as the best way to learn this trade. A substantial proportion of workers, however, have acquired roofing skills informally, by working as helpers or handymen, observing or being taught by experienced roofers.

Apprenticeship applicants are required to be at least 18 and not over 30 years of age; however, exceptions may be made for veterans. A high school education or its equivalent is desirable. Good physical condition and a good sense of balance are important assets.

The 3-year apprenticeship program generally consists of a minimum of 1,400 hours of on-the-job training annually, in addition to related classroom instruction. In a typical training program, the apprentice learns, among other things, to use, care for, and handle safely the tools, equipment, and materials commonly used in the trade; work with composition, tar, and asphalt; prepare roof surfaces for covering; apply pitch and other materials; spread gravel; install slate, tile, and terra cotta; and dampproof and waterproof structures.

The trainee receives related classroom instruction in such subjects as blueprint reading and mathematics applicable to layout work.

Hourly wage rates for apprentices usually start at 65 percent of the journeyman rate and increase periodically until 90 percent of the journeyman rate is reached in the final 6 months of the training period.

Roofers may advance to foreman and to superintendent for a roofing contractor. Also, they may enter business for themselves and hire other roofers.

Employment Outlook

Employment of roofers—who numbered about 60,000 in 1970—is expected to increase rapidly through the 1970's. In addition to new jobs created by employment growth, thousands of job opportunities will result from the replacement of journeymen who transfer to other occupations, retire, or die. Retirements and deaths alone are expected to result in several hundred job openings annually.

Employment of roofers is expected to increase mainly because of the anticipated rapid increase in construction activity. (See discussion, p. 375.) New construction and repairs on existing structures will provide most of the work for these craftsmen. However, dampproofing and waterproofing are expected to provide an increasing proportion of roofers' work.

Although the projected increase in construction activity will result in rising employment of roofers, employment growth will be limited by the increasing use of spray-on or fluid roofing systems; improved roofing materials and roofing techniques that increase the "life" of roofs; improved tools, such as nailing machines; and more efficient materials handling equipment.

Earnings and Working Conditions

Union minimum hourly wage rates for composition roofers averaged $6.17, on July 1, 1970, according to a national survey of building trades workers in 68 large cities. For slate and tile roofers, the rate was $5.81. By comparison, the average for all journeymen in the building trades was $6.54 an hour. Among individual cities surveyed, the minimum hourly rates for composition roofers ranged from $3 in Norfolk, Va., to $7.57 in Detroit, Mich. Slate and tile roofers had hourly rates ranging from $3 in Norfolk, Va., to $8.07 in Detroit, Mich. Straight-time hourly earnings, excluding fringe benefits or payments to health, insurance, or pension funds, for roofers in 12 of the 68 cities selected to show wage information from various areas and regions of the country, on July 1, 1970, appear in the accompanying tabulation.

City	*Rate per hour*	
	Composition	*Slate and tile*
Atlanta	$4.35	$4.60
Boston	6.55	6.55
Cleveland	7.56	7.56
Dallas	4.70	4.85
Kansas City	5.32	5.32
Milwaukee	5.97	6.12
New Orleans	5.10	5.10
New York City	6.70	6.80
Pittsburgh	6.80	6.80
San Diego	5.25	5.25
Spokane	5.80	5.80
Syracuse	6.95	6.95

Roofers' work, like that of other building tradesmen, is sometimes strenuous. It involves prolonged standing, as well as climbing, bending, and squatting. These workers risk injuries from slips or falls from scaffolds or roofs. They may have to work outdoors in all types of weather, particularly when doing repair work. Roofing work may be especially hot during the warmer months.

A large proportion of roofers are members of the United Slate, Tile and Composition Roofers, Damp and Waterproof Workers Association.

Sources of Additional Information

For further information concerning roofing apprenticeships or other work opportunities in this trade, inquiries should be directed to local roofing contractors; a local of the United Slate, Tile and Composition Roofers, Damp and Waterproof Workers Association; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other training opportunities.

General information about the work of roofers may be obtained from:

National Roofing Contractors Association, 1515 North Harlem Ave., Oak Park, Ill. 60302.

United Slate, Tile and Composition Roofers, Damp and Waterproof Workers Association, 1125 17th St. NW., Washington, D.C. 20036.

SHEET-METAL WORKERS

(D.O.T. 804.281 and .884)

Nature of the Work

Sheet-metal workers engaged in construction-related work fabricate and install ducts used in ventilating, air-conditioning, and heating systems. They also fabricate and install a wide variety of other products made from thin metal sheets, such as roofing and siding, partitions, store fronts, and metal framework for neon signs. Skilled construction sheet-metal workers should not be confused with assembly-line factory operatives who also make sheet-metal products, but can perform only a few specific operations.

In heating or air-conditioning duct work, the sheet-metal worker lays out and plans the job and determines the size and type of sheet metal to be used. The ducts are often fabricated at the sheet-metal shop. Sheet-metal workers cut the metal with hand snips, power-driven shears, and other cutting tools. They shape the metal with a variety of machines, hammers, and anvils; then weld, bolt, rivet, solder, or cement the seams and joints. However, fabricated ducts in standard sizes often are available and require little additional fabrication at the work site. In the installation of ducts, components are fitted together; hangers and braces installed for support; and points soldered, connected, or welded. Some journeymen specialize in shopwork or on-site installation. However, skilled workers must know all aspects of the trade.

Places of Employment

Sheet-metal workers are employed mainly by firms that fabricate and install heating, refrigeration, and air-conditioning equipment, and by contractors engaged in residential, industrial, and commercial building. In residential construction, these workers also may work for roofing contractors who specialize in metal roofing work. Many of these craftsmen work for government agencies or business establishments that do their own construction and alteration work. Others are self-employed, mainly on repair work or on smaller types of installation.

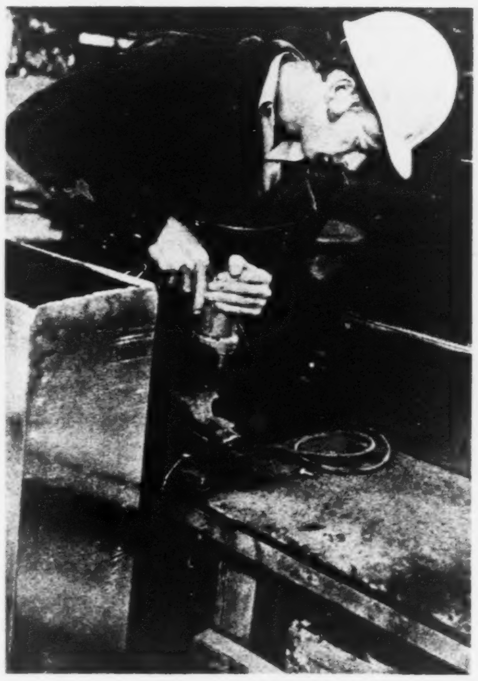
In addition to construction-related work, thousands of skilled sheet-metal workers are employed in nonconstruction; for example, the railroad, aircraft, or shipbuilding industries. Some are employed in small shops manufacturing specialty products, such as custom kitchen equipment for hotels and restaurants. Firms making blowers, exhausts, electrical generating and distributing equipment, food products machinery, steam engines, and turbines also employ skilled sheet-metal workers.

Training, Other Qualifications, and Advancement

Most training authorities, including the National Joint (labor-management) Apprenticeship and Training Committee for the Sheet Metal Industry, recommend the completion of a 4-year apprenticeship program as the best way to learn the sheet-metal trade. Some sheet-metal workers, however, have acquired skills of the trade informally, by working as helpers or handymen, observing or being taught by experienced craftsmen. Many of these persons have gained additional knowledge of the trade by taking correspondence or trade school courses.

Apprenticeship applicants generally are required to be between 17 and 23, but special consideration may be given for military service. A high school education or its equivalent is required. Good physical and mechanical aptitude are necessary assets.

The apprenticeship program usually consists of 8,000 hours (4 years) of on-the-job training, in addition to related classroom instruction. In a typical training program, the apprentice learns, among other things, to use, care for, and handle safely the tools, machines, equipment, and materials commonly used in the trade. Also, he learns how to do welding, soldering, and seaming; air-conditioning, heating, and ventilating work; residential installations such as roofing, gutters, and downspouts; and architectural and industrial sheet-metal work. In addition, he learns general work processes such as cutting, forming, folding, grooving metal material, bending edges, and punching and drilling holes.



Sheet-metal worker drills sheeting.

The trainee receives related classroom instruction in subjects such as drafting, blueprint reading, and mathematics applicable to layout work. In addition, he learns the relationship between sheet-metal work and other building trades.

Hourly wage rates for sheet-metal apprentices generally start at 45 percent of the journeyman rate and increase periodically until 80 percent of the journeyman rate is reached during the final portion of the training period.

Sheet-metal workers in construction may advance to foreman, superintendent of large projects, or go into business as sheet-metal contractors. Experienced workers in this trade have more job mobility than many other building trades workers because they can transfer their skills to nonconstruction industries.

Employment Outlook

Employment of sheet-metal workers—who numbered about 60,000 in 1970—is expected to increase rapidly through the 1970's. In addition to new jobs created by employment growth, thousands of job opportunities will result from the replacement of journeymen who transfer to other fields of work, retire, or die. Retirements and deaths alone are expected to result in several hundred job openings annually.

The projected increase in employment of sheet-metal workers is expected mainly because of the anticipated large expansion in residential, commercial, and industrial construction. (See discussion, p. 375.) In addition, year-round, central air-conditioning systems are expected to be installed in a greater number of homes, office buildings, schools, hospitals, department stores and factories. Many of these installations will be in existing structures. Sheet-metal work should also result from growth in the number of large refrigeration systems. Such equipment will be needed in the production and storage of growing quantities of food and other perishable items required by an expanding population. The shops that fabricate sheet-metal products used in construction also are expected to require more of these skilled craftsmen.

Prefabrication is not likely to affect the growth of employment in this occupation as much as in most other building trades, because much sheet-metal work is custom made. The fabrication of ducts and fittings for ventilating installations is limited by the need to tailor these installations to meet a wide variety of structural conditions, such as the dimensions of the building and the space allowed for ducts, and also by the cost of storage space needed to store prefabricated ducts and fittings.

Earnings and Working Conditions

Union minimum hourly wage rates for sheet-metal workers averaged $6.75, compared with $6.54 for all journeymen in the building trades on July 1, 1970, according to a national survey of building trades workers in 68 large cities. Among individual cities surveyed, the minimum hourly rates for sheet-metal workers ranged from $4.65 in Norfolk, Va., to $8.81 in Cleveland, Ohio. Straight-time hourly earnings, excluding fringe benefits or payments to health, insurance, or pension funds, for sheet-metal workers in 12 of the 68 cities selected to show wage information from various areas and regions of the country, on July 1, 1970, appear in the accompanying tabulation.

City	*Rate per hour*
Albuquerque	$5.88
Boston	7.33
Buffalo	7.35
Cincinnati	6.79
Des Moines	6.27
Houston	5.69
Kansas City	6.78
Pittsburgh	7.23
Sacramento	7.00
San Diego	7.34
Tampa	5.85
Washington, D.C.	6.50

Many sheet-metal workers spend considerable time at the construction site, where they may work either indoors or outdoors. Other sheet-metal workers may work primarily indoors, doing fabricating and layout work.

When installing gutters, skylights, and cornices, they may work high above the ground level. When installing ventilation and air-conditioning systems, they may work in awkward and relatively inaccessible places. Sheet-metal workers run the risk of cuts and burns from the materials, tools, and equipment used in their trade.

A large proportion of sheet-metal workers are members of the Sheet Metal Workers' International Association.

Sources of Additional Information

For further information regarding sheet-metal apprenticeships or other work opportunities in this trade, inquiries should be directed to local sheet-metal contractors or heating, refrigeration, or air-conditioning contractors; a local of the Sheet Metal Workers' International Association; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of sheet-metal workers may be obtained from:

Sheet Metal and Air Conditioning Contractors' National Association, Inc., 1611 North Kent St., Arlington, Va. 22209.

Sheet Metal Workers' International Association, 1000 Connecticut Ave. NW., Washington, D.C. 20036.

STONEMASONS

(D.O.T. 861.131 and .781)

Nature of the Work

Stonemasons build the stone exteriors of structures. They work primarily with two types of stones—natural cut stone, such as marble, granite, limestone, or sandstone; and artificial stone, which is made to order from cement, marble chips, or other types of masonry materials. Much of the work of these craftsmen is the setting of cut stone for comparatively high-cost structures, such as office buildings, hotels, churches, and public buildings.

The stonemason often works from a set of drawings in which each stone has been numbered for identification. A helper locates the pieces needed and brings them to the mason. A derrickman using a hoist may be required to lift large stones into place. The stonemason sets the stone in mortar and moves it into position with a mallet, hammer, or crowbar. He alines the stone with a plumb line and finishes the joints between the stones with a pointing trowel. When necessary, he may fasten the stone to supports with metal ties, anchors, or by welding.

Occasionally, the stonemason may have to cut stone to an exact size. To do this, he must determine the grain of the stone selected and strike blows along a predetermined line with a stonemason's hammer. Valuable stones are often cut with an abrasive saw to make them fit.

Stonemasons also do some stone veneer work, in which cut stone is applied in various patterns to the exterior of a building. In some sections of the country, stone is used extensively to veneer homes. In one

Stone masons adjust stone floor panel.

specialized branch of the trade known as alberene stone setting, stonemasons set acid-resistant soap-stone linings for vats, tanks, and floors.

The principal handtools of the stonemason are trowels, heavy hammers, wooden or hard rubber mallets, and chisels. For rapid stone cutting, pneumatic tools are used, such as hammers, drills, and brushing tools. Special power tools smooth the surface of large stones. An abrasive saw is used for fine cutting.

Places of Employment

Stonemasons work most often on new construction, particularly on the more expensive residential and commercial and public buildings. A few also work for government agencies or business establishments that handle their own construction and alteration work. Stonemasons are employed mainly in the larger urban areas. In many areas which have no stonemasons, bricklayers perform the work.

Training, Other Qualifications, and Advancement

Most training authorities, including the National Joint (labor-management) Bricklaying Apprenticeship Committee, recommend the completion of a 3-year apprenticeship program as the best way to learn stonemasonry. A substantial proportion of stonemasons, however, have picked up the trade by working as helpers, observing or being taught by experienced stonemasons.

Apprenticeship applicants generally are required to be between 17 and 24; a high school education or its equivalent is desirable. Good physical condition is an important asset.

The apprentice training program for stonemasons generally requires 6,000 hours (3 years) of on-the-job training, in addition to related classroom instruction. During the apprenticeship, the trainee learns to use, care for, and handle safely the tools, machines, and materials of the trade. He must also learn to lay out and install walls, floors, stairs, and arches. The apprenticeship program in this occupation is similar to that for bricklayer. (See discussion, p. 380.)

Stonemasons may advance to jobs as foremen. They may also become estimators for stonemasonry contractors. Estimators compute labor and material requirements for competitive job bidding. A few of these craftsmen may start their own contracting business.

Employment Outlook

Little increase in the employment of stonemasons is expected through the 1970's, in spite of the anticipated large expansion in construction activity. (See discussion, p. 375.) Less use of stone masonry work is expected because modern architectural design has emphasized simple lines, little ornamentation, and large window areas. Replacement needs will provide a small number of job opportunities for new workers each year.

Earnings and Working Conditions

Union minimum hourly wage rates for stonemasons averaged $6.73, compared with $6.54 for all journeymen in the building trades, on July 1, 1970, according to a national survey of building trades workers in 68 large cities. Among individual cities surveyed, the minimum hourly rates for stonemasons ranged from $4.95 in Jacksonville, Fla., to $8.16 in Cleveland, Ohio. Straight-time hourly earnings, excluding fringe benefits or payments to health, insurance, or pension funds, for stonemasons in 12 of the 68 cities selected to show wage rates from various areas and regions of the country, on July 1, 1970, appear in the accompanying tabulation.

City	*Rate per hour*
Albuquerque	$6.31
Birmingham	5.55
Boston	7.25
Chicago	7.22
Des Moines	6.43
Houston	5.90
Knoxville	6.02
Los Angeles	5.95
Phoenix	6.80
Pittsburgh	7.51
Seattle	7.20
Washington, D.C.	6.80

Since most stonemasonry is done outdoors, working hours are often lost because of inclement weather. The work of the stonemason is active and sometimes strenuous, as it involves lifting heavy materials.

A large proportion of stonemasons are members of the Bricklayers, Masons and Plasterers' International Union of America.

Sources of Additional Information

For further information regarding apprenticeships for stonemasons or other work opportunities in this trade, inquiries should be directed to local bricklaying contractors; a local of the Bricklayers, Masons and Plasterers' International Union of America; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about apprenticeship and other training opportunities.

General information about the work of stonemasons may be obtained from:

Bricklayers, Masons and Plasterers' International Union of America,
815 15th St. NW., Washington,
D.C. 20005.

STRUCTURAL-, ORNAMENTAL-, AND REINFORCING-IRONWORKERS, RIGGERS, AND MACHINE MOVERS

(D.O.T. 801.131, .134, .281, .381, .781, .884; 809.130, .131, .134, .380, .381, .781, .884, .887; and 869.883)

Nature of the Work

Ironworkers erect, assemble, or install fabricated metal products mainly in industrial, commercial, and large residential buildings. They also rig heavy construction machinery (prepare the machinery for moving with the proper lines, cables, and accessories) and deliver the machinery to new sites. In addition, ironworkers do alteration work, such as installing steel stairs or adding window guards to existing buildings, and repair or remodel existing structures, such as replacing metal bridge parts.

Ironworkers comprise four related trades—structural ironworkers, rigger and machine mover, ornamental-ironworker, and reinforcing-ironworker (rodman). Many craftsmen are skilled in two or more of these trades.

Structural-ironworkers (D.O.T. 809.381) erect the steel framework of bridges, buildings, and other structures including metal storage tanks and overhead crane runways that support heavy equipment. They install floor decking and the doors and frames of vaults.

In erecting a steel framework, structural-ironworkers push, pull, or

Rodmen position reinforcing bars.

pry fabricated steel beams and girders into proper position while hoisting equipment hold steel parts. Next, they temporarily connect all steel members with bolts, use plumb bobs and levels to aline the structure, and then weld or bolt the pieces. In a large building ironworkers generally specialize in a particular operation, such as welding or bolting. Structural-ironworkers often rig, as well as erect, steel structures.

Riggers and machine movers (D.O.T. 869.883) set up and rig hoisting equipment to erect and dismantle structural steel frames and move heavy construction machinery and equipment. They study the size, shape, and weight of the object to be moved; choose the lines and cables with which the object can be safely moved; and select the points of attachment that will provide a safe and secure hold on the load. Next, they attach the lifting device to both the hoisting equipment and the item to be moved, and direct the load into position by giving hand signals and other directions to the hoisting machine operator. In many instances, special rigging equipment must be built on the job to move unusual shaped materials and machines. This work requires a knowledge of hoisting equipment and lifting devices.

Ornamental-ironworkers (D.O.T. 809.381) install metal stairways, catwalks, floor gratings, iron ladders (such as those used extensively in powerhouses and chemical plants), metal window sash and doors, grilles and screens (such as those used in bank tellers' compartments and elevators), metal cabinets, and safety deposit boxes. They also install lampposts, gates, fences, and decorative ironwork on balconies.

In addition to iron and steel, ornamental-ironworkers work with prefabricated alumimum, brass, and bronze metal shapes, frames, and panels. Examples are recently-developed curtain-wall and window-wall, and the many types and designs of ornamental and functional building facades which are bolted or welded to a building or other structure.

Reinforcing-ironworkers (rodmen) (D.O.T. 801.884) set steel bars in concrete forms to reinforce concrete structures. They place the steel bars on suitable supports in the concrete form and tie the bars together at intersections so that each bar receives its intended structural load. The bars are placed in the concrete form according to blueprints, specifications, or verbal instruction. The rodmen use steel pliers and other tying tools to wire the rods securely in place. Some concrete reinforcing is a coarse mesh made of welded wire (usually 6- by 6-inch grids). When using mesh, the rodmen measure the surface to be covered, cut and bend the mesh to the desired shape, and place the mesh over the area to be reinforced. When the concrete crew pours the slab, hooked rods are used to position the wire mesh in the freshly poured mixture.

Places of Employment

About 85,000 structural- and ornamental-ironworkers were employed in 1970. Thousands of additional workers were employed as riggers, machine movers, and reinforcing-iron workers.

A large proportion of these craftsmen are employed by general contractors on large building projects, by steel-erection contractors, or ornamental-iron contractors. Many are employed by large steel companies or their subsidiaries engaged in the construction of bridges, dams, and large buildings. Some work for government agencies, public utilities, or large industrial establishments that do their own construction work. Few of these craftsmen are self-employed.

Training and Other Qualifications

Most training authorities recommend the completion of a 3-year apprenticeship as the best way to learn these trades.

Apprenticeship applicants are required to be between 18 and 30. Good physical condition is required. A high school education or its equivalent is desirable.

The apprenticeship program for ironworkers usually consists of 6,000 hours (3 years) of on-the-job training, given either by the foreman or an experienced journeyman. In a typical training program, the apprentice learns, among other things, to use, care for, and handle safely the tools, machines, equipment, and materials commonly used in the trade; read blueprints and working drawings; form, shape, drill, tap, and erect and assemble various metal structures; lay out and assemble various metal structures; lay out and assemble steel stairs, fire escapes, grilles, railings, fences, doors, and related metal structures; and erect, place, and tie reinforcing iron. He also learns arc and gas welding; acetylene cutting; rigging, bolting, and riveting; and how to repair and alter metal structures.

The apprenticeship program generally includes a minimum of 144 hours a year of related classroom instruction in subjects such as drafting, blueprint reading, and mathematics applicable to layout work.

Areawide apprenticeship programs, sometimes covering an en-

tire State or region, are found extensively in ironworking trades. They are supervised by joint apprenticeship committees composed of representatives of the International Association of Bridge, Structural and Ornamental Iron Workers' local unions and local management groups.

Hourly wage rates for apprentices start at 60 percent of the journeyman rate and increase periodically until the journeyman rate is reached at the completion of the apprenticeship. In some localities, the starting rate may be as high as 75 percent of the journeyman rate.

Employment Outlook

Employment in these trades is expected to increase rapidly through the 1970's. In addition to new jobs created by employment growth, the replacement of experienced ironworkers who transfer to other occupations, retire, or die will provide a few thousand job opportunities each year. Retirements and deaths alone are expected to result in several hundred job openings annually.

A continued rapid rise in employment of these workers is expected principally because of the anticipated large increase in construction activity. (See discussion, p. 375.) The job outlook in these trades also will be affected favorably by the increased use of structural steel in smaller buildings. Also, the development of lightweight and specialty steels has improved the competitive position of steel as a construction material and resulted in increasing job opportunities for structural-iron workers. Work opportunities for ornamental-ironworkers will result from the growing use of ornamental panels of aluminum, porcelainized steel, or other metals which are attached to the exterior wall of large buildings; and by the use of metal frames to hold large glass installations. The demand for riggers and machine movers is expected to increase because of the expanding use of heavy construction machinery. The use of prestressed concrete in a growing variety of structures will increase job opportunities for reinforcing-iron workers.

Technological developments are expected to limit employment growth of ironworkers. For example, a compact squirt-welding machine has greatly reduced the time needed for field welding. Structural steel frames are being assembled on the ground and hoisted into vertical position to reduce iron work above ground. Prestressed steel beams making possible longer spans with less steel are being used increasingly in bridge construction. Also available are almost completely prefabricated and painted short-span bridges made of prestressed steel, which can be erected in 1 day. Also, prefabricated reinforcing mats or fabrics which reduce on-site rod bending, tying, and welding are being used increasingly in highways and buildings. In addition, manufacturers are designing an increasing variety of ornamental metal products for more efficient on-site installation.

Earnings and Working Conditions

Union minimum hourly wage rates for structural-ironworkers and rodmen averaged $6.72 and $6.64, respectively, on July 1, 1970, according to a national survey of building trades workers in 68 large cities. The average for all journeymen in the building trades surveyed was $6.54. Among individual cities, the minimum hourly rate for structural-iron workers ranged from $4.88 in Lubbock, Tex., to $8.60 in Chicago, Ill. The rates for rodmen ranged from $4.87 in San Antonio, Tex., to $8.60 in Chicago, Ill. The rates for ornamental-ironworkers, riggers, and machine movers are generally about the same as those for structural-ironworkers.

Straight-time hourly earnings, excluding fringe benefits or payments to health, insurance, or pension funds, for structural-ironworkers and rodmen in 12 of the 68 cities selected to show wage rates from various areas and regions of the country, on July 1, 1970, appear in the accompanying tabulation.

City	*Rate per hour*	
	Structural-Iron-workers	*Rodmen*
Atlanta	$5.60	$5.60
Baltimore	6.91	6.91
Boston	7.64	7.64
Cleveland	7.95	7.95
Denver	6.25	6.25
Detroit	7.25	6.86
Los Angeles	6.48	6.37
Minneapolis-St. Paul	6.95	6.95
Philadelphia	7.07	7.70
St. Louis	6.53	6.53
San Diego	6.48	6.37
Tulsa	5.75	5.75

Since materials used in ironworking trades are heavy and bulky, above-average physical strength is necessary. Agility and a good sense of balance also are required to work at great heights and on narrow footings. Although many ironworkers risk injury from falls, safety devices, such as nets and scaffolding, have reduced the frequency of accidents.

Ironwork often involves considerable travel, because demand is insufficient to keep local crews constantly employed. Consequently, workers must be imported to handle occasional large construction projects. Large contractors may keep a small crew continually employed by moving them from job to job.

A large proportion of workers in these trades are members of the International Association of Bridge, Structural and Ornamental Iron Workers.

Sources of Additional Information

For further information concerning apprenticeships or other work opportunities in these trades, inquiries should be directed to local general contractors; a local of the International Association of Bridge, Structural and Ornamental Iron Workers; a local joint union-management apprenticeship committee; or the nearest office or the State apprenticeship agency of the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of ironworkers may be obtained from:

Associated General Contractors of America, Inc., 1957 E St. NW., Washington, D.C. 20006.

DRIVING OCCUPATIONS

More than 2.5 million truck, bus, and taxicab drivers were engaged in moving passengers and goods over highways and city streets in 1970. They transported thousands of products used in homes, schools, and factories, and also transported millions of people every day.

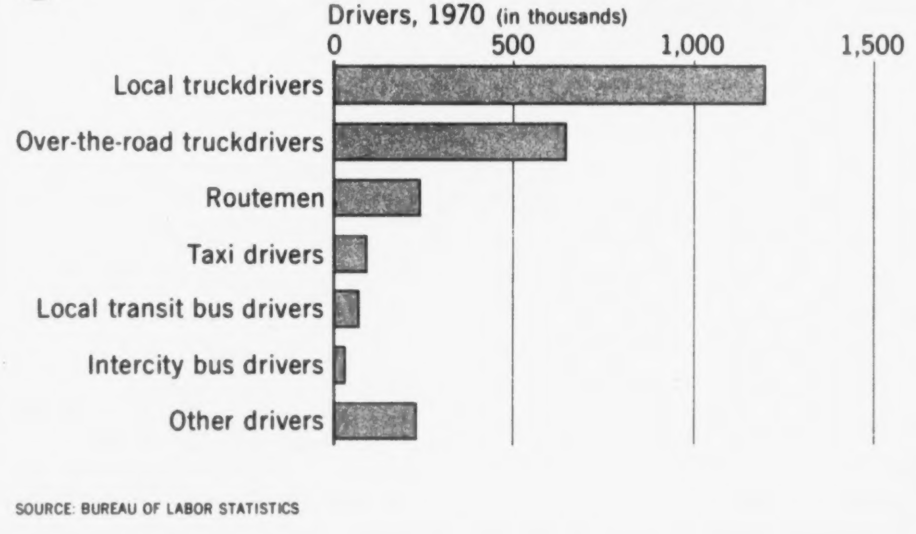
Some men employed in the driving occupations drive practically all their working time. Others are occupied much of the time in loading and unloading goods, making pickups and deliveries, and collecting money. Still others, like the routeman, spend a good deal of their time selling. The individual statements that follow deal only with employment opportunities for those whose principal occupation is driving intercity and local trucks and buses and taxis. For example, they do not cover schoolbus drivers, chauffeurs, part-time taxi drivers, ambulance drivers, or employees whose driving is incidental to their regular duties.

Many driving jobs require a high degree of responsibility. Drivers, for the most part, operate large and expensive equipment which they must drive carefully, obeying safety regulations and traffic laws, to deliver their passengers and freight safely. These men are free from direct supervision.

During the 1970's, employment of local and over-the-road truckdrivers is expected to expand as a result of increases in the freight moved by motor carrier. Employment in other driving jobs is not expected to change much in the years ahead. Normal turnover in this large occupational field also will provide many job opportunities each year.

Driving jobs offer excellent opportunities for young men who are not planning to attend college and have no interest in or aptitude for craft or technical occupations. The pay of most drivers is relatively high, and working conditions are fairly good. Many young men also will enjoy the freedom from close supervision and the frequent contacts with people, which are characteristic of most of these jobs.

(26) **Nearly half of all drivers are local truckdrivers**



SOURCE: BUREAU OF LABOR STATISTICS

OVER-THE-ROAD TRUCKDRIVERS

(D.O.T. 903.883; 904.883; 905.883; and 909.883)

Nature of the Work

The men at the wheel of the big trucks on highways and turnpikes are the top professional drivers. They drive the largest and most expensive equipment and receive the highest wages of all drivers. They are on their own practically all the time and have much responsibility. The work requires initiative, because they must transport goods of great value which must be delivered safely and on time.

Most over-the-road drivers operate gasoline or diesel-powered tractor-trailers. They deliver goods over long distances—frequently driving at night.

Unlike the local truckdriver who spends considerable time in loading and unloading, the over-the-road driver (sometimes called intercity line-haul or long-haul driver) drives practically all of his working time. He sometimes may handle the freight. Some drivers, for example, may have to unload the goods they deliver to stores at night when receiving crews are not available. Drivers of long-distance moving vans generally have to load or unload their cargoes with the assistance of local helpers.

The truckdriver must back up big trailers to loading platforms; this requires the ability to maneuver the trailers while driving in reverse. He must also be able to judge distance accurately while driving around corners or through narrow passageways.

Because the over-the-road truckdriver spends most of his time driving, safe driving practices and courtesy are of the utmost importance. Everyone has seen the emergency warning signals set out by a driver near his disabled truck. Many motorists have noted the courtesy of truckdrivers who pull off the road at the top of the hill to allow the accumulated traffic to pass.

U.S. Department of Transportion (U.S. DOT) regulations require drivers to inspect their trucks before and after trips and make out reports on the condition of the vehicle at the end of the run. Drivers also are required to keep a daily log of their activities. If a driver has an accident, he must make out a detailed report. These regulations also prescribe special safety precautions concerning packing and loading flammable, explosive, or otherwise hazardous materials, and over-the-road driving of trucks containing these materials.

Where Employed

An estimated 655,000 over-the-road drivers were employed throughout the United States in 1970. Many work out of large cities such as Chicago and Los Angeles; however, some large companies have their operating headquarters in small towns.

Over-the-road drivers are employed by private and for-hire carriers. Private carriers are companies, such as chain food stores or manufacturing plants, which use their own or leased trucks to transport their goods. For-hire carriers are either common carriers (trucking companies serving the general public) or contract carriers (trucking firms hauling goods under contract for certain companies). Although the drivers on long intercity runs are employed more often by common carriers, an increasing number in recent years have been working for private or exempt (from U.S. DOT regulation) carriers, or for specialized carriers handling large pieces of machinery, explosives, or missiles. On shorter hauls, many drivers are employed by contract and common carriers to make deliveries of machinery, food, petroleum products, household appliances, and other items, from plants to warehouses and from warehouses to large volume purchasers.

Training, Other Qualifications, and Advancement

Regulations of the U.S. DOT establish minimum qualifications for over-the-road drivers engaged in interstate or foreign commerce. The driver must be at least 21 years of age and able-bodied. His vision should be at least 24/40 with or without glasses; good hearing also is necessary. He must be able to read and speak English; have at least 1 year's driving experience, which may include driving private automobiles; and have a good driving record.

He is required also to complete successfully a road test that demonstrates his driving skills and a written test that indicates an adequate knowledge of driving regulations. Most States require truckdrivers to have a chauffeur's license, which is a commercial driving permit obtained from State Motor Vehicle Departments.

Most fleet operators have higher hiring standards than those described above. Many firms will not hire drivers under age 25; some specify height and weight limitations. Many require at least a grade school education; others require 2 years of high school. Some companies employ only applicants who have had several years of experience in handling vehicles of the type they would be required to drive.

The standards for over-the-road drivers generally are higher than those for local truckdrivers. Furthermore, these standards are more strictly adhered to than those for local drivers, whose standards may be lowered when there are not enough applicants for jobs.

Tractor-trailers usually cost between $25,000 and $40,000, and the load inside may be worth more than $100,000. The owners of such valuable equipment, therefore, employ experienced drivers who also can accept great responsibility.

Driver training is a common method of preparing for truckdriving jobs. Many training authorities and employers recommend taking the driver-training courses offered by high schools. If such a course is not available, the driving schools which operate in most large cities are recommended. A high school course in automotive mechanics also is helpful.

A small number of private technical-vocational schools offer truck driving courses. Students receive instructions on driving large vehicles in close quarters and on the highway, with emphasis on safe driving practices. Instructions also are given on care of equipment and freight, and compliance with Federal, State, and local regulations. Truck driving experience is also helpful.

Long-haul driving is a senior driving job, and most of these drivers have had previous experience in local trucking. Usually, they enter this occupation by first driving small trucks. Then, after gaining experience, they get jobs driving the larger and more complicated trucks. A young person also may begin as a helper to a local truckdriver, assisting him in loading and unloading the truck, occasionally doing some relief driving.

All employers are interested in obtaining good, safe, reliable drivers, but the methods of selection and training vary. Some have formal tests and training programs. Others hire on the basis of personal interviews; their training programs may consist of a "break-in" period during which the new employee observes and works with an experienced driver.

Applicants for jobs as over-the-road drivers are required to pass a physical examination which is usually paid for by the employer. Many firms also give written traffic and driving knowledge tests. Some employers give tests to measure factors such as sharpness and field of vision, reaction time, ability to judge speed, and emotional stability. The last step in the selection of drivers is the road test. The applicant is expected to demonstrate his ability to handle, under a variety of driving conditions, a vehicle of the type and size he will operate in regular service. A few States require such a test before licensing a driver to operate a tractor-trailer.

A new driver may be given a brief indoctrination course covering company policy and the preparation of various forms used on the job. He then will make one or more training trips with an instructor or an experienced driver.

Drivers employed by common carriers frequently start on the "extra board," bidding for regular runs on the basis of seniority as vacancies occur. (The extra board is a list of men, assigned in rotation, who substitute for regular drivers or who make extra trips when necessary.) Drivers for private carriers are more likely to begin with assigned regular routes.

Opportunities for promotion in this occupation are limited. A few drivers may advance to jobs as safety supervisors, driver supervisors, and dispatchers. However, these jobs are often unattractive to over-the-road truckdrivers, since the starting pay is usually less than the pay on truckdriving jobs. Most drivers can expect to advance only on the basis of seniority to driving runs that provide increased earnings or preferred schedules and working conditions.

Employment Outlook

Employment of over-the-road truckdrivers is expected to increase moderately through the 1970's.

Substantial growth in the volume of intercity freight is anticipated, resulting from increased commercial and industrial activity and the continued decentralization of industry. A large number of job openings also will be created by transfers from this field of work to other occupations.

Another reason for expected increases in freight carried by over-the-road trucks is the general economic growth of the Nation, and this trend is expected to continue. Many factories, warehouses, and stores are being located at great distances from each other in suburban or semirural areas where rail facilities are nonexistent or extremely limited. The intercity highway building program has aided the trucking industry in this regard. Furthermore, the growth of chainstores and the trend to smaller inventories and decentralization of factories require daily coordination of shipping; this can be handled best by trucks.

Improvements in trailer design to handle certain kinds of freight such as frozen goods and livestock for extended distances has expanded the opportunities for over-the-road trucking.

Demand for trucking services may increase in the future as a result of new trucking methods which promise reduced handling and shipping time and reduce freight costs for small loads. One example is the increasing use of "double-bottoms"—two trailers hitched in tandem to a tractor. When two trailers are used, they can be unhitched at the truck terminal and promptly delivered to different customers, thus eliminating the need to unpack a larger trailer, separate its contents, and repack on local delivery trucks.

Handling time also is being reduced through the practice of packing all freight destined for a single customer or area into large containers or cargo cages which can be handled at the truck terminal more conveniently and quickly than individual packages.

Some recent freight transportation innovations will limit somewhat the anticipated increase in trucking business and driver employment. For example, the movement of highway trailers on railroad flatcars, ocean vessels, and aircraft saves the cost of driver, fuel, and tractor, and appears to have prospects for considerable expansion. To compensate for job displacement that may arise from these innovations, there is a growing practice under labor-management agreements to provide for retirement at an earlier age.

Further limitations on employment expansion among over-the-road drivers are related to changes in State laws. State limitations on truck weight, size, and speed are becoming less restrictive as a result of the construction of better highways and improved travel arteries inside the cities. The movement of bigger loads at higher average speeds could result in a need for fewer drivers than would otherwise be required.

Earnings and Working Conditions

Most over-the-road drivers earned more than $200 a week in 1970. Drivers employed by Class I common carriers of general freight (carriers with gross operating revenues of $1 million or more a year) had estimated annual average earnings of $12,600 in 1970. More experienced over-the-road drivers can earn considerably more than this average. The rates are fairly uniform because this is a highly unionized field, and union-employer contracts are generally master agreements covering all employers within a region—an area including a number of States. The earnings of an individual driver are affected by factors such as mileage driven, number of hours worked, type of equipment driven or the weight of the loads carried, and type of "run" (whether or not pickup or delivery en route is required). Earnings also are affected by the nature of the cargo carried, with premium rates paid for transporting flammable or otherwise hazardous commodities.

Some private carriers pay their drivers on the same basis as their other employees—a monthly, weekly, or daily wage. Generally, such a wage is for a specified number of hours, and, if the driver works additional hours, he receives extra pay.

Motor carriers engaged in interstate or foreign commerce are subject to the U.S. DOT rules governing hours of work and other matters. These regulations limit the hours over-the-road drivers may work in order to be certain the driver receives a reasonable amount of rest. For example, no driver may be on duty for more than 60 hours in any 7-day period, but for carriers operating every day of the week, the driver may remain on duty for a maximum of 70 hours in any period of 8 consecutive days. The regulations also provide that no driver may drive more than 10 hours without first having an off-duty period of at least 8 hours. For drivers who drive less than 10 hours, but perform other work for the motor carrier in a garage, warehouse, or other place, the regulations prohibit resumption of driving after any combination of driving time and other on-duty work which totals 15 hours, unless the driver has first had at least 8 hours off duty. Many drivers, particularly on the very long runs, work fairly close to the maximum hours permitted. A workweek of at least 50 hours is very common.

Most drivers receive pay for 6 or more National, State, and local holidays. They also have paid vacations, usually from 1 to 4 weeks, depending upon their length of service. Health insurance and pension plans, paid for by the employers, are very common.

Over-the-road truckdrivers often are required to spend time away from home—particularly when they drive long runs. The driver often starts out in the evening and arrives at the terminal in the other city the following morning. In such instances, the company provides lodging for him either in a company dormitory or a hotel. In the evening, he starts on his return trip and arrives at the home terminal the following morning. He may make two or three such round trips a week.

Some companies use two-man sleeper teams on their very long runs. One drives while the other sleeps in a berth behind the cab.

Although earnings on sleeper runs are the highest in this field of work, few drivers stay with this type of run very long. The work is very tiring and requires being away from family and friends for days and even weeks. However, many drivers go back to sleeper runs after they have had a rest or have done some relay driving.

The earnings of drivers of long-distance moving vans are quite high, but their hours are long and the work is strenuous. They drive more miles than the average over-the-road driver and also work more hours in loading and unloading goods.

Largely because of intensive safety programs and drivers' skill, the accident rate in over-the-road trucking is low. Injuries occur less frequently than in other forms of motor transportation.

The physical strain of over-the-road truckdriving has been reduced by more comfortable seating, better highways, and more stringent safety regulations. Sitting in one place for hours at a time, however, is tiring and the nervous strain of sustained driving at night also is fatiguing.

Most over-the-road drivers are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Some drivers of private carriers belong to unions representing the plant employees of the companies for which they work.

Sources of Additional Information

Information on career opportunities may be obtained from:

American Trucking Association,
1616 P St. NW., Washington,
D.C. 20036.

LOCAL TRUCKDRIVERS

(D.O.T. 900.883; 902.883; 903.883; 906.883; and 909.883)

Nature of the Work

Much of the food, clothing, and other products required by consumers is transported by trucks. The men who move these goods from terminals, warehouses, mines, and factories to wholesalers, retailers, and consumers in tne local area must be skilled drivers to avoid accidents on congested city streets. They also must be able to maneuver big trucks or tractor-trailers into tight parking spaces, through narrow alleys, and up to loading platforms. (Telephone linemen, repairmen, and many thousands of other workers for whom driving is incidental to their primary duties are not included in this discussion.)

When the local truckdriver reports to work at the terminal or warehouse, he receives his assignment to make deliveries, pickups, or both. He also receives the delivery forms he will need and checks the condition of his truck. His truck generally is loaded for him by platform men. If he does the loading himself, however, and must make many deliveries, he arranges the items in proper sequence so that there will be a minimum of handling. At the customer's place of business, the driver generally loads and unloads the merchandise himself. If he has heavy loads such as machinery, or if he has many deliveries to make during the day, he may have a helper to assist him. The driver of a moving van usually has a crew of helpers to assist him in loading and unloading household or office furniture.

At the delivery points, the driver gets customers to sign receipts and freight bills, and he sometimes collects money for freight, c.o.d. deliveries, and other charges. At the end of his day, he turns in all receipts and cash collected and records his time and the deliveries made. He also reports whatever maintenance or repair is needed before his truck is used again.

Some of these workers drive special types of trucks, such as dump or oil trucks, which require the operation of mechanical levers, pedals, or other equipment. If they haul heavy machinery, they operate mechanical hoists to load and unload the machines.

Places of Employment

Over 1.2 million workers were employed as local truckdrivers in 1970, mostly in and around large metropolitan areas; however, they work in all localities.

A large majority of local drivers work for businesses which deliver their own products and goods—such as department stores, meat-packers and other food processors, wholesale distributors, grocery chains, petroleum companies, and construction companies. Many others are employed by local for-hire operators—trucking companies which serve the general public or specific companies under contract. Some are employed by the Federal Government, particularly the Post Office Department, and by States and municipalities. A large number are in business for themselves.

Training, Other Qualifications, and Advancement

Qualifications for local truck-drivers vary considerably, depending upon factors such as the type of equipment to be operated and the nature of the employer's business. Generally, applicants must be 21 years of age or older. Some employers prefer applicants who have completed 2 to 4 years of high school. The applicant must be physically able to lift heavy objects and otherwise be in good health. He should have good hearing and good vision, with or without glasses. Since a driver often deals directly with the public, employers look for people who are tactful and courteous.

An applicant must have a chauffeur's license, which is a commercial driving permit. Familiarity with traffic laws and safety measures is necessary, and some previous experience in driving a truck is helpful. A young person may obtain such experience by working as a truck-driver's helper. Employers also give consideration to driving experience gained in the Armed Forces.

Since he will be responsible for costly vehicles and cargo, a truck-driver must be cautious, alert, and able to judge distances and to coordinate his reactions to avoid accidents in congested traffic. To demonstrate these qualifications, an applicant's driving ability is tested, and he may have to pass a written examination as well as a general physical examination. Employers generally will check applicants for traffic and police records.

Training given to new drivers is often informal and may consist only of riding with and observing an experienced driver on the job. Additional training may be given if they are to drive a special type of truck. Some companies give a brief indoctrination course which lasts 1 or 2 days and covers general duties, the efficient operation and loading of a truck, company policies, and the preparation of delivery forms and company records.

Although most new employees are assigned immediately to regular driving jobs, some start as extra drivers, covering the routes of regular drivers who are ill or on vacation, or making extra trips when necessary. They receive regular assignments when openings occur.

Local truckdrivers may transfer to jobs as dispatchers or advance to jobs such as terminal managers or supervisors, or to traffic work—for example, in planning delivery schedules. However, these jobs are relatively few. For the most part, advancement for a local truckdriver consists of earning higher hourly wages by driving heavy or special type truck loads instead of light trucks or by transferring to over-the-road truckdriving.

An experienced truckdriver who has some business ability and ambition can start his own trucking company, when he has sufficient capital to purchase expensive trucking equipment and to meet other business expenses. Truckers who own one or two vehicles continue to account for a sizable proportion of local for-hire trucking businesses.

Employment Outlook

A moderate increase in the employment of local truckdrivers is anticipated through the 1970's because of the expected increase in volume of freight. Many new workers also will be needed to replace drivers who transfer to other fields of work, retire, or die. Retirements and deaths alone will result in more than 15,000 job openings each year for local truckdrivers.

The rise in total business activity anticipated in the years ahead will increase the volume of freight. Since trucks carry virtually all freight for local distribution and do not compete for hauling with other types of carriers, this anticipated increase in total intercity and local freight volume will expand local trucking business and, thereby, truckdriver employment. The continued growth of suburban areas will contribute to the employment of more drivers.

Some recent developments may offset somewhat the growth in the number of local truckdrivers that would otherwise occur with an increase in freight volume. For example, the trend toward larger deliveries to relatively fewer retail outlets is the result of the growth of chainstores and shopping centers. (On the other hand, as suburban areas expand, local truckers tend to service a wider area, increasing the travel time per truck.) The introduction of new equipment, such as power tailgates for loading and unloading also may affect the number of drivers who will be needed to deliver large and heavy loads. Also, the use of radio telephones to instruct drivers en route will reduce the time needed for deliveries. Innovation in local trucking will continue to be limited, however, by narrow city streets, heavy traffic, and local city ordinances controlling the size and weight of local delivery trucks. However, urban renewal and urban highway building projects may improve driving conditions.

Earnings and Working Conditions

On the average, hourly union wage scales were $4.41 for local truckdrivers and $3.91 for helpers on July 1, 1970, according to a survey in 68 large cities. Average hourly pay scales for drivers ranged from $5.17 in Sacramento, Calif., to $3.63 in Washington, D.C. However, wage scales vary, even in the same city, depending on the type of trucking service (such as general freight hauling or local moving and storage), the types of product hauled, and the size and type of truck operated.

As a rule, local truckdrivers are paid by the hour and receive extra pay for working overtime, usually after 40 hours. Some drivers are guaranteed minimum daily or weekly earnings. Local truckdrivers frequently work 48 hours or more a week and thus often drive 6 days a week. Although daytime work is customary, nightwork or early morning work is sometimes necessary, particularly for drivers handling foodstuffs for chain grocery stores, produce markets, or bakeries. Most drivers deliver over regular routes or runs, although some may be assigned different routes when they report to work each day.

Local truckdrivers generally have paid vacations of 1 or 2 weeks after a year of service and up to 4 weeks after 15 years. In addition, they usually receive pay for seven or more National, State, and local holidays.

A majority of local truckdrivers belong to unions. Most of them belong to the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Some local truckdrivers employed by private carriers are members of unions representing the plant workers of their employers.

Practically all unionized local truckdrivers and their helpers are covered by life and health insurance and pension plans which are almost always paid for by the employer. When uniforms are required, the cost usually is paid for entirely or partly by the employer, who also may provide for their upkeep.

Local truckdrivers, because they drive in heavy traffic, are subject to nervous strain. The actual operation of a truck has become less physically demanding because of improvements such as power steering and more comfortable seating. However, when local drivers make many deliveries during a day, their work can be exhausting. Some drivers may develop physical disorders, such as back strain and hernia. Local truckdrivers, however, do have certain work advantages, such as steady employment. Unlike over-the-road drivers, they usually work a regular day-time schedule and return home in the evenings.

ROUTEMEN

(D.O.T. 292.358)

Nature of the Work

Routemen are as much salesmen as they are drivers. In fact, they are sometimes known as *driver-salesmen* or *route-salesmen*. They must, through their selling ability, increase sales to existing customers and obtain new business by canvassing potential customers within their territories. Routemen drive panel or light trucks over an assigned route, selling and delivering goods, or providing services such as collecting and delivering laundry and dry cleaning, to retail establishments (wholesale routemen) or directly to the public (retail routemen). Wholesale routemen usually drive heavier trucks. These trucks are refrigerated when dairy products or frozen foods are carried.

Before starting on his daily route, the routeman loads or supervises the loading of his truck. The amount of merchandise in his truck generally is checked by another employee. Some routemen deliver merchandise previously ordered and obtain orders for future delivery. Others make immediate sales from the stock in the truck. In either case, they must collect payments and keep records of their transactions. When they check in at the plant after completing their routes, they empty their trucks and turn in their collections to the cashier. The retail routemen serving homes make from 5 to 10 times as many stops as the wholesale routemen who serve stores and other business establishments.

Routemen's work varies according to the industry in which they are employed, the type of routes they have (retail or wholesale), and the company employing them. Some specific examples, however, may describe in a general way what most routemen do.

A typical day for a dry-cleaning routeman begins when he picks up cleaned garments at the processing plant and loads his truck, which is equipped with carrying racks. He delivers the garments to homes or business establishments and picks up soiled clothing. He marks the soiled articles so that they may be identified at the plant. Sometimes, he makes notes of the type of stains or of special processes to be used such as waterproofing. Each cleaned garment has an itemized bill attached so that he can collect the amount of money due.

Although all routemen must be able to get along well with people, it is particularly important for the dry-cleaning and laundry routeman. His reaction to complaints and requests for special services may be the difference between increasing business or losing customers. Periodically, he calls at homes and business establishments along his route which are not using his company's services to try to get their trade.

A wholesale routeman may deliver bakery products to grocery stores. His truck is loaded the night before or early in the morning, and he checks to see whether he has the proper variety and quantity of products before starting on his route. He stops at from 10 to 50 grocery stores. At each stop he brings the orders of bread and other bakery products into the store and arranges them on the display racks in the best possible display space he can secure. Together with the store owner or manager, he checks the merchandise he has delivered. He also credits the store for the value of the stale bread and cakes left over from the previous delivery.

This routeman prepares a list of products he plans to deliver the next day. This list represents his estimate of the amount of bakery products that will be sold by the grocery stores. From time to time, he calls on grocers along his route, who are not his customers, and tries to get orders from them.

The vending machine routeman, although he merchandises his products through machine, must try to anticipate customers' needs for service and preferences for merchandise. In trying, continually, to find profitable new locations for the vending machines he services, the routeman approaches the managers of various businesses about the placement and relocation of his machines. He caters to the customers' demand by noting their preferences for merchandise sold at each machine location and stocks each machine with items that sell best.

The vending machine routeman also must make certain that his machines are supplied adequately with merchandise, that they function properly, and that they are clean and attractive. At each location, the routeman checks the items remaining in the machine and the money deposited in the cash box to determine that what has been sold is accounted for. He tests stock delivery and change-making mechanisms to make sure that items and change are dispensed properly when coins are inserted; he may make minor adjustments to machines that are not working properly. He cleans the machine, removing waste, spillage, and accumulated dust, and then replaces depleted stock. The routeman keeps an exact record of the merchandise that goes into each machine and a precise account of how much money is removed.

Places of Employment

About 240,000 routemen worked for a wide variety of businesses in 1970. Since most of them were employed by companies which distributed food products or provided personal services, they worked in small towns as well as in large cities throughout the country. The greatest concentration of employment, however, was in dairies, bakeries, food and beverage distributors, and drycleaning plants in the large cities.

Some were engaged in wholesale distribution of goods and services to stores and other business establishments. The majority, however, distributed goods and services to homeowners and apartment dwellers. Many companies employed both wholesale and retail routemen.

Training, Other Qualifications, and Advancement

In addition to being a good driver, a routeman must have sales ability. To induce people to buy, he must have a thorough knowledge of the product or service he is selling and a persuasive personality. Other important sales qualifications are a pleasant voice, ability to speak well, and a neat appearance. He also needs to have self-confidence, initiative, and tact.

He must be able to work without direct supervision, do simple arithmetic, and write legibly. In most States, a routeman is required to have a chauffeur's license, which is a commercial driving permit. Information regarding this license can be obtained from State Motor Vehicle Departments.

Applicants for jobs as vending machine routemen should have some mechanical ability. Routemen are expected to check the operation of automatic dispensing machines and make necessary adjustments and minor repairs. In case of major malfunctions in equipment, they should be able to report the nature of the trouble.

Most employers require their routemen to be high school graduates, preferably 25 years of age or older. Many large companies give applicants aptitude and other psychological tests to determine whether they will make good salesmen and safe drivers. Those who handle a great deal of money may have to be bonded.

Training for entering the occupation can be obtained through high school courses in salesmanship, public speaking, driver-training, bookkeeping and business arithmetic. School-and-work programs in retail and wholesale merchandising are helpful to a person interested in entering this occupation. Immediately after high school graduation, valuable experience may be obtained as a sales clerk in a store or in some other type of selling job.

Another method of entering this occupation is to get a job as a *routeman helper* (D.O.T. 292.887). For this job, employers usually hire persons 18 years of age or over who have a driver's license. Helpers are not likely to be used in the dairy or vending machine industries, however. Still another way of becoming a routeman is to get a job (plant or office) in a bakery, dairy, laundry, or drycleaning establishment. After learning something about the business, a young person may transfer to a job as a routeman when an opening occurs.

Most companies give their routemen on-the-job training which varies in length and thoroughness. Many large companies have classes in salesmanship. Some companies assign newly hired routemen for brief periods to jobs in the different departments of the plant to familiarize them with all the processing operations so that they can answer customers' questions intelligently and be better salesmen.

Routemen may be promoted to route foreman or sales supervisor, but these jobs are relatively scarce. Advancement usually is limited to moving from a retail to a wholesale route, where earnings are generally higher. However, some routemen obtain better paying sales jobs as a result of the experience gained in route selling.

Employment Outlook

The total number of routemen is expected to change little in the 1970's, although job opportunities will vary among different types of employers. There will be a few thousand additional openings for new workers each year as experienced workers transfer to other fields of work, retire, or die.

The number of retail routemen declined in the decade following World War II, particularly among drivers handling milk and dairy products. However, the decline appears to have run its course, and some employment upturn is likely. The convenience of home delivery to suburban families consuming large quantites of milk and dairy products makes such service popular, despite the growth of local shopping centers. For laundry and drycleaning retail routemen, the outlook is for an increase in employment, in line with population growth, especially in areas with a large concentration of apartment houses. The increasing number of married women working outside the home will result also in the commercial handling of more laundry or cleaning work.

Employment of wholesale routemen probably will remain at about present levels or decline slightly. Although large supermarkets have been replacing small neighborhood stores, more supermarkets are being built in the suburban areas. The number of routemen will not increase correspondingly, however. There has been a growing trend toward larger delivery trucks. Moreover, in recent years, some manufacturers and wholesale food companies have replaced their routemen with salesmen who cover assigned territories by automobile, and truckdrivers who make the deliveries.

On the other hand, opportunities for employment as vending machine routemen will be excellent through the 1970's because of the expected rapid increase in the volume of machine-vended merchandise. Some of the factors expected to stimulate the industry's growth are the development of new and improved machines and the greater use of automatic food service in industrial plants, schools, hospitals, department stores, and other high-traffic areas.

Earnings and Working Conditions

Most routemen receive a minimum salary plus a percent of the sales they make. Thus, the earnings of routemen are determined largely by their selling ability and initiative. According to limited information available in 1970, wholesale routemen in the dairy and baking industries had minimum weekly salaries ranging from $100 to $170. Including commissions on sales, many of these routemen earned $200 a week and more. Wholesale routemen usually earn more than retail routemen because they sell much larger quantities of products. However, they receive a lower commission on each sale.

The number of hours worked by routemen varies. Some work only about 30 hours a week; others may work as many as 60 hours or more a week, depending upon whether the individual has a well-established route or whether he is trying to build up a new one, whether he has a retail or a wholesale route, and how ambitious he is. For some, the hours of work generally are limited by union-management contract. In other cases, the contract specifies merely the earliest hour that work may begin and the latest quitting time. The hours may also vary according to seasonal peaks and lows. During the spring-cleaning season, for example, drycleaning routemen may work about 60 hours a week; in the winter, they may work less than 30 hours a week.

Many companies require routemen to wear uniforms. Some employers pay for the uniforms and for keeping them clean.

Most routemen receive paid vacations, generally ranging from 1 to 4 weeks, depending upon length of service, and 6 paid holidays or more a year. Many employers provide hospitalization and medical benefits; some have pension plans.

The routeman is on his own to a great extent. He does not work under strict supervision and, within certain broad limits, may decide how fast he will work and where and when he will have his lunch or rest period. This freedom of action and the daily meeting and dealing with people on the route appeal to many young men. On the other hand, a retail routeman has to make deliveries in bad weather and do a great deal of lifting, carrying, and walking up and down stairs. He also may have to work unusual hours. For example, retail routemen delivering milk generally work in the very early morning hours.

Many routemen, particularly those delivering bakery and dairy products, are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Some belong to the unions which represent the plant workers of their employers.

INTERCITY BUSDRIVERS

(D.O.T. 913.363 and 913.463)

Nature of the Work

The drivers of the buses that travel between cities are selected on the basis of their driving skill, driving record, emotional stability, and courtesy. A driver's duties generally begin when he reports to the terminal for his assignment. Before beginning his scheduled trip, he inspects the bus carefully at the terminal or garage. He checks the fuel, oil, water, and tires, and makes certain that the bus is carrying safety equipment, such as fire extinguishers, first-aid kit, flags, and flares. The driver also picks up the tickets, change, report blanks, and other items needed for his trip.

The driver moves his empty bus from the terminal or garage to the proper loading platform, where he takes on his passengers. He collects fares—tickets usually—from the passengers as they board the bus and announces the destination, route, time of arrival, and other information concerning the trip. The driver also loads or supervises the loading of baggage and package express into the baggage compartment. He also collects cash fares from passengers who board the bus between stations where tickets are sold.

The driver operates the bus carefully at speeds which will enable him to arrive at and leave regular bus stops according to established time schedules. On many runs, he also stops momentarily at other designated points to discharge or pick up passengers, and load or unload baggage and package express wherever necessary. He announces regular stops and rest or lunch stops. The driver also regulates lighting, heating, and air-conditioning equipment for the passengers' comfort. In an emergency, he sometimes is required to make minor road repairs, such as changing tires, for which he generally receives extra pay.

Upon arriving at his final destination, the driver unloads or supervises the unloading of the remaining baggage. He prepares reports on mileage, time, and fares, as required by company rules. He also keeps a log of hours as required by the U.S. Department of Transportation (U.S. DOT). The driver must make a complete report if an accident or unusual delay occurs.

Places of Employment

Approximately 25,400 intercity busdrivers were employed by about 1,050 bus companies in 1970. About three-fourths of these drivers worked for Class I intercity companies—those with annual revenues of over $200,000. Intercity busdrivers are employed in the many small communities served by bus, as well as in the larger cities where home and regional offices and major terminals of bus companies are located.

Training, Other Qualifications, and Advancement

All intercity busdrivers are required to meet minimum age, health, and experience qualifications established by the U.S. DOT. The minimum age requirement is 21 years. The applicant must be able-bodied and have good hearing and at least 20/40 eyesight, with or without glasses. He must have at least 1 year's driving experience (through all four seasons) with a good driving record and must be able to read and speak English.

Many intercity bus companies, however, have considerably higher requirements. Most of these companies prefer applicants to be at least 24 years of age and have a high school education or its equivalent. Applicants often are given comprehensive examinations to determine their driving skill, intelligence, temperament, and personality.

Young persons interested in becoming busdrivers should have good foot-hand-and-eye coordination, be able to judge distances accurately, and react quickly. An even temperament and emotional stability are other important qualifications because busdrivers work under considerable tension when they operate large vehicles in heavy and swiftly moving traffic. Since they represent their companies in dealing with passengers, busdrivers also must be courteous and tactful.

Although previous experience in the operation of a truck or bus is not required, it is preferred by some employers. In most States, the law requires that a trainee for a busdriver's job must have or obtain a chauffeur's license, which is a commercial driving permit.

Most intercity bus companies conduct training programs for beginning drivers. These programs, which usually last from 2 to 6 weeks but can extend to 3 months, include both classroom and driving instruction. In the classroom, the trainee is instructed in company and U.S. DOT rules; State and municipal regulations; safe driving practices; rates, schedules, and timetables; and dealing with the public. He also is taught how to keep clerical records, inspect the bus, and make minor emergency repairs.

The trainee then rides with a regular driver to observe safe driving practices and other aspects of the job. He also makes trial runs, without passengers, to demonstrate his driving skill. After satisfactorily completing the training, which includes final driving and written examinations, the new driver begins a "break-in" period. During this period, working under strict supervision, he makes regularly scheduled trips with passengers.

New workers start out on the "extra board," which is a list of drivers on call who are given temporary assignments. While on the extra board, the new driver may substitute for a regular driver who is ill or on vacation, drive a second or overload section, make an extra trip if necessary, or drive chartered buses. Extra drivers may have to wait several years before they have the necessary seniority to receive a regular assignment. However, if it becomes necessary for a company to lay off some of its drivers, the

extra drivers will be the first to lose their jobs and the last to be rehired. In almost all companies, it is necessary for a beginning employee to serve a probationary period lasting, as a rule, from 30 to 90 days.

Opportunities for promotion generally are somewhat limited, particularly in small companies. An experienced driver may be promoted to a job as dispatcher, supervisor, or terminal manager. For most drivers, advancement consists of receiving better assignments with higher earnings as their seniority increases.

Employment Outlook

The number of intercity busdrivers is expected to increase slowly through the 1970's because of further increase in intercity bus travel. Also, several hundred additional openings will be available each year in this relatively small occupation as replacements for drivers who transfer to other fields of work, retire, or die.

Population growth and higher consumer incomes during the years ahead should result in an increase in travel generally. Some part of this increase is expected to be by bus. New and improved highways are expected to enhance travel by bus by making possible a reduction in schedule running time for bus travel.

Earnings and Working Conditions

The wages of intercity busdrivers typically are computed on a mileage basis. Rates ranged from 10 to 15 cents a mile in 1970. Drivers (including extra men) employed by Class I intercity bus companies had estimated annual average earnings of $10,800 in 1970. Many regular drivers employed by these companies earned considerably more than $10,000 a year.

Most regular drivers are guaranteed specified wages in terms of miles or hours per pay period. For all work other than their regular assignments or "tours of duty," they receive additional pay, customarily at premium rates.

Extra drivers usually are paid by the hour when they are on call but not driving, and are paid the regular mileage rate when actually driving. Drivers usually start at a minimum rate and receive increases at intervals of 6 months or a year. The maximum rate generally is reached at the end of 2 years. Extra men generally earn slightly less than regular drivers but, if enough work is available, they may earn as much or more than regular drivers. Extra drivers receive a weekly or biweekly guarantee either in minimum hours, mileage, or earnings.

Most drivers who work for the large companies average between 32 and 36 hours driving time a week. Driving schedules may range from 6 to 10 hours a day and from 3½ to 6 days a week.

U.S. DOT regulations limit the hours of work of intercity busdrivers. According to these regulations, intercity drivers may drive no more than 10 hours without having at least 8 hours off. Drivers also are limited to 60 hours of "on-duty" time in a 7-day period; those who work for carriers that operate every day of the week, however, are limited to 70 hours in an 8-day period. "On-duty" is the period from the time the driver is required to report for work until he is relieved. For those who drive less than 10 hours but perform other work for the bus company, the regulations prohibit resumption of driving after any combination of driving and other on-duty time which totals 15 hours, unless the driver first has had at least 8 hours off duty.

Most intercity busdrivers belong to the Amalgamated Transit Union. The Brotherhood of Railroad Trainmen, and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.) also have organized intercity busdrivers in some areas.

Labor-management contracts covering many intercity busdrivers provide for health and life insurance paid for by the employer, whereas pension plans under such agreements are usually financed jointly by the workers and their employers.

Drivers are given vacations with pay ranging from 1 to 5 weeks, depending on the company for which they work and their length of service. Many also receive a minimum of 8 paid holidays. When away from home terminals overnight, drivers employed by some companies receive pay for food and lodging.

Driving an intercity bus usually is not physically burdensome, but it is demanding and requires steady nerves. The busdriver is given a great deal of independence in his job and is solely responsible for the safety of the passengers and bus. Many drivers enjoy working without direct supervision and take pride in assuming these responsibilities. Some drivers enjoy the opportunity to travel and to meet the public.

Among the less desirable aspects of this job are weekend and holiday work and the necessity of being away from home for varying periods. Also, extra drivers are on call at all hours and may be required to work at any time on very short notice. In addition, drivers that have little seniority sometimes may be laid off when business declines.

Sources of Additional Information

For information regarding job opportunities for an intercity busdriver, a young man should apply to intercity bus companies or the local office of the State employment service.

LOCAL TRANSIT BUSDRIVERS

(D.O.T. 913.363 and 913.463)

Nature of the Work

Local busdrivers transport millions of Americans to and from work, schools, and homes every day. These drivers follow definite time schedules and routes over city and suburban streets to get passengers to their destinations on time.

The local busdriver's workday begins when he reports to the terminal or garage. There, he is assigned his bus and receives his change, tokens, transfers, passes, and any other items needed. Before starting the run, the driver usually is required to check the tires, brakes and lights. Some very small local bus companies also may require him to check the water, oil, and fuel.

On most runs, the driver makes regular stops every block or two, where he operates the controls of the bus doors to enable passengers to enter and leave the vehicle. As the passengers board the bus, the driver collects cash fares, tokens, tickets, or transfers, and also issues transfers, and in many places, sells tokens, and makes change. The local busdriver often answers questions concerning schedules, routes, transfer points, and street numbers, and sometimes is required to call out the name of the street at each regular bus stop. He also regulates heating, air conditioning, and light equipment to keep the passengers comfortable.

At the end of his day's run, the busdriver turns in a trip sheet which usually includes a record of fares received, trips made, and any delays in schedule. In case of an accident or unusual delay, the driver must make out a comprehensive report on its nature and cause.

Places of Employment

In 1970, nearly 69,000 busdrivers were employed by about 1,090 local transit bus companies. A small proportion of these drivers were women. Approximately one-half the total worked in large cities where the transit system was publicly owned, such as Boston, Chicago, Cleveland, Detroit, Los Angeles, Miami, New York, Pittsburg, St. Louis, and San Francisco. In addition to those employed by the local transit bus industry, some local drivers work for charter and sightseeing lines, government agencies, and companies which specialize in operating schoolbuses. (There are also more than 200,000 schoolbus drivers, most of whom are part-time drivers.) A few drivers are employed by Federal, State, and local governments.

Although many drivers work in major metropolitan areas such as New York, Chicago, and Detroit, some are employed in almost every community in the Nation.

Training, Other Qualifications, and Advancement

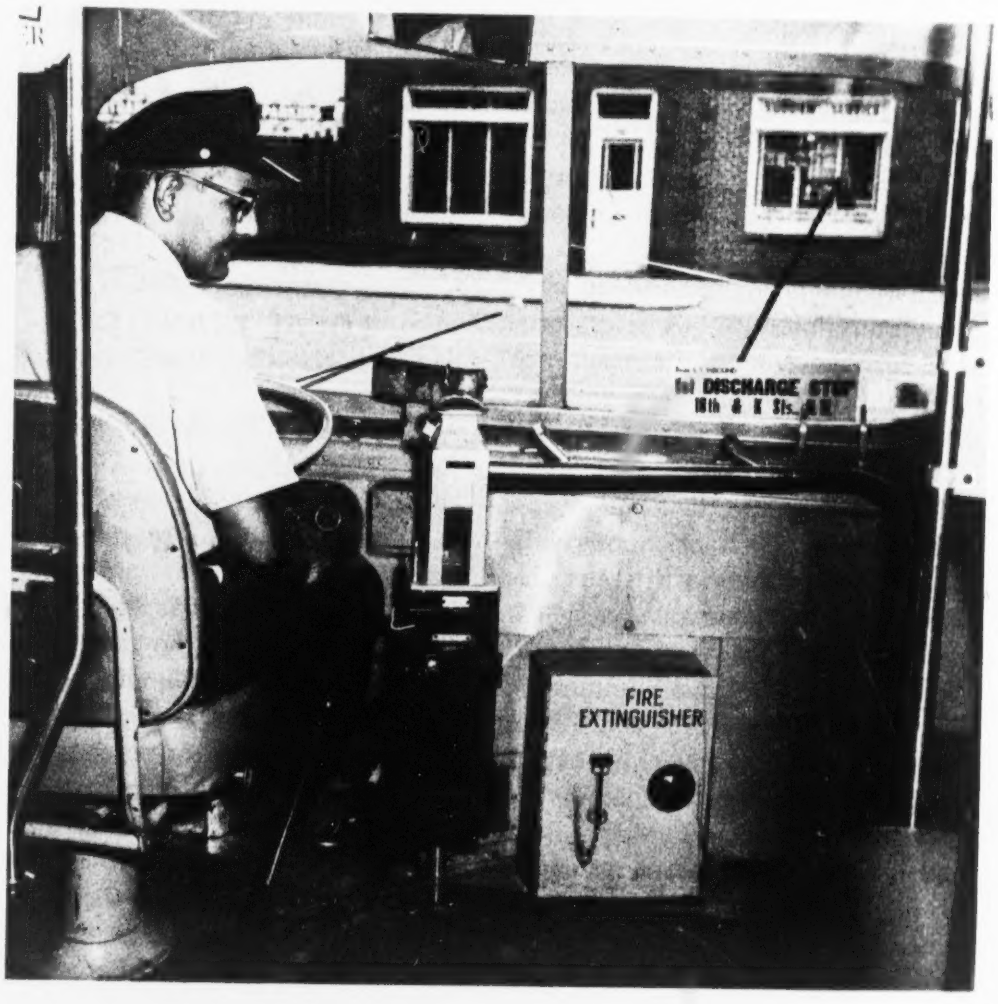
Applicants for busdriver positions should be between the ages of 21 and 40, of average height and weight, and have good eyesight—with or without glasses. The applicant must be in good health, have no physical disabilities, and must be able to pass the written and physical examinations given by most employers. He must be able to judge distance accurately, have good hand-eye coordination, and have quick reflexes. Because the driver often works under pressure and deals with many different personalities, an even temperament and emotional stability are important. Although educational requirements are not high, many employers prefer applicants that have a high school education or its equivalent.

A motor vehicle operator's permit and, generally, 1 or 2 years of driving experience on some type of motor vehicle are basic requirements. A good driving record is essential because a busdriver is responsible for the safety of his passengers. Most States require busdrivers to have a chauffeur's license which permits the holder to operate commerical motor vehicles. This license may be obtained either during or immediately after the driver's training period. Some employers prefer drivers who have had experience operating a truck or bus.

Most local transit companies conduct training courses which may last several weeks and include both classroom and driving instructions. In the classroom, the trainee is taught company rules, safety regulations, and safe driving practices. He is taught how to keep records and how to deal tactfully and courteously with passengers. The trainee's driving instruction consists of supervised trips both with and without passengers. At the conclusion of his training, the new driver often is required to pass a written and final driving examination before he starts on a run.

After passing the examinations, he is placed on the "extra" list. While on this list, he substitutes for regular drivers who are ill or on vacation and also makes extra trips in the morning or evening rush hours. He also may drive charter or sightseeing runs and other extra runs such as special service buses for public meetings and sporting events. In almost all companies it is necessary for a beginning employee to serve a probationary period—generally lasting for 30 to 90 days. He may remain on the extra list until he has the necessary seniority to obtain a regular run. It may take from several months to several years before he is assigned a regular run.

Promotional opportunities in regular driving jobs generally are limited. Experienced drivers may advance to jobs such as instructor, dis-



patcher, road supervisor, and, sometimes, executive. Promotion in municipally owned bus systems is usually by examination. The opportunities for advancement of most drivers are limited to assignments to more desirable runs. Only after acquiring sufficient seniority do the drivers receive these assignments.

Employment Outlook

There will be a small number of opportunities for new workers to enter this occupation each year through the 1970's, even though employment of local busdrivers is expected to continue to decline (but at a slower rate than in the past). These openings will result from the need to replace drivers who transfer to other fields of work, retire, or die. Retirements and deaths alone may account for about 1,200 openings each year.

In recent years, the volume of passenger traffic handled by the local transit bus industry has declined significantly. The main cause of this decline has been the rapid rise in the number of private automobiles and their increasing use in both city and suburban areas. Another factor has been the rapid growth of suburbs, most of which have a wide variety of stores, theaters, restaurants, and other services in their shopping centers. Because most suburban shopping centers have good parking facilities and are reached easily by automobile, many suburban residents have found it unnecessary to use public transportation for shopping or other activities. The increasing numbers of people employed in suburban areas are likely to rely more on private automobile transportation than those employed in downtown areas. In addition, increasing traffic congestion and parking problems in most downtown sections have led to the decline of many central business districts. This decline, in turn, has resulted in some curtailment of downtown bus service between rush hours.

As local transit bus traffic declined steadily in recent years and bus schedules and routes were curtailed or entirely eliminated, the employment of busdrivers also declined. The decline in employment was limited, however, partly because transit companies are not completely free to curtail or eliminate unprofitable routes, since the companies are usually regulated by State or municipal authorities.

Downtown traffic congestion and parking problems will continue to encourage bus travel in downtown areas, and the growing need for bus service for school children in the suburbs is an additional factor which may slow the downward trend in busdriver employment. Some increase in the number of publicly owned companies may occur. This increase would favorably affect busdriver employment, since such companies often provide service on unprofitable routes in the public interest.

Earnings and Working Conditions

Local transit busdrivers are usually paid by the hour, and earnings vary according to locality, length of service, size of company or city, and length and type of run. Nearly all companies pay the maximum job rate after 12 months' service. According to a survey of basic hourly wage scales set by union-employer contracts for busdrivers in 66 large cities, the average hourly rate was $3.99 on July 1, 1970. Hourly scales were highest in the larger cities in the Great Lakes, Pacific, New England, and Middle Atlantic regions. Among the cities surveyed, the hourly pay scales for experienced busdrivers ranged from $2.26 in Topeka, Kansas to $4.60 in Boston, Mass. Wage scales for beginning drivers were generally 5 to 15 cents an hour less.

Most busdrivers have a standard work schedule of 8 hours a day, 40 hours a week. For additional work, drivers usually receive 1½ times their hourly rates. In many companies, drivers often work in excess of their standard work schedule, thereby increasing their weekly earnings. Drivers on the extra list generally are guaranteed a minimum number of hours of work or a minimum weekly salary.

The workweek for regular drivers usually consists of any 5 consecutive days; Saturdays and Sundays are counted as regular workdays. Most transit companies run some buses in the evening and a few companies operate 24 hours a day. Therefore, some drivers have to work at night. To accommodate the varying demands of commuter travel, it is necessary for many local transit busdrivers to work "swing shifts." On these runs the operator drives for several hours, is off duty for a period of time, then returns to work for several hours. If the total elapsed time between the beginning and end of a swing shift exceeds 10 or 11 hours, the driver generally receives extra pay. Other assignments are "straight runs" which are unbroken except for meal periods. Some union contracts require 50 to 60 percent of all assignments to be straight runs.

Nearly all local transit busdrivers are covered by labor-management contracts which provide for life and health insurance, and pension plans; the major pension plans are financed jointly by the workers and their employers, while many life and health insurance plans are paid for solely by the employer. Drivers also are given vacations with pay ranging from 1 to 5 weeks or more, depending on the length of service, and usually 6 or 7 or more paid holidays a year.

Although driving a bus is not physically exhausting, busdrivers are exposed to the nervous tension which arises from driving a large vehicle on heavily congested streets and dealing with many types of passengers. In addition to driving a bus, they must collect fares, answer questions, see that passengers are clear of the doors, and request riders to move to the rear.

Among the more favorable aspects of this job is steady year-round employment once a driver receives a regular assignment. Busdrivers are usually free of direct supervision—which many drivers also find desirable. Drivers take pride in being solely responsible for the safety of the passengers and bus and in acting as the bus company's representative to the general public.

Most busdrivers are members of the Amalgamated Transit Union. Drivers in New York City and several other large cities belong to the Transport Workers Union of America. The Brotherhood of Railroad Trainmen and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.) also have organized some local transit busdrivers.

Sources of Additional Information

For information on employment opportunities for local busdrivers, inquiry should be made at the transit company in the local area or to the local office of the State employment service.

TAXI DRIVERS

(D.O.T. 913.363)

Nature of the Work

In practically all communities, taxicabs are an essential part of the regular transportation system. They offer a type of individualized service not otherwise available, since they operate without the fixed routes and schedules of public buses. As a result, the taxidriver can offer a flexible independent service to individual customers, which provides most of the advantages they would have in using their own private automobiles.

Taxicab drivers, in addition to providing transportation, also perform other services. For example, they assist passengers in and out of the cab, handle their luggage, and also may pick up and deliver packages. In some communities, cabs are used for transporting crippled children to and from school. Cabdrivers occasionally provide sightseeing tours for out-of-town visitors.

Drivers get their "fares" or passengers in one or more ways. The majority of taxicab fleets are equipped with two-way radio systems over which requests for taxicabs are transmitted to the driver. These companies also have cabstands at which drivers may wait for phone calls from their central dispatching office, which will direct them to pick up passengers. Many drivers wait in front of theaters, hotels, bus terminals, railroad stations, and other buildings which may have large numbers of prospective passengers. In small cities and in suburban areas, drivers may work from a central location, such as a terminal, to which they return after each trip. The driver also may pick up passengers while he is returning to his stand or station. A good driver keeps himself informed on what is happening in the city, where crowds will gather (for example, at theaters, and baseball and football games) and when the crowds will disperse, so that he can be on hand to pick up passengers.

Drivers usually are required to keep records, such as the date, time, and place passengers were picked up, and the destination, time of arrival, and amount of fare collected. If the cabdriver owns his own cab or if he rents a cab over an extended period of time, he must clean the cab periodically, as required by regulations in many municipalities. In large cab companies, this job generally is performed by cleaners employed by the company.

Places of Employment

In 1970, about 100,000 taxi drivers, including a small number of women, were employed full time in the taxicab industry, which is made up of both privately owned cabs and fleets of company-owned vehicles. In addition, perhaps as many were employed part time.

Although taxicab drivers are employed in every metropolitan area in the country, the greatest concentration of these workers is found in large cities. New York City, Washington, D.C., Chicago, Philadelphia, Boston, New Orleans, Detroit, St. Louis, and Baltimore lead in the employment of cabdrivers.

Training, Other Qualifications, and Advancement

To become a taxi driver in most large cities, it is necessary to have, in addition to a State-issued chauffeur's license, a special taxicab operator's license issued by the local police, safety department, or Public Utilities Commission. Although licensing requirements vary considerably among cities, in general, applicants must be over 21 and in good health, have a good driving record, and have no criminal record. A driver's record is checked for arrests, both locally and through the Federal Bureau of Investigation (FBI).

Most large communities require an applicant for a taxi driver's license to pass a written examination on taxicab and traffic regulations. The examination may include questions on street locations, insurance regulations, accident reports, lost articles, zoning or meter rules, and passenger pickup and deliveries. In some cities, the cab company will teach the driver-applicant taxicab regulations and the location of streets and important buildings. In other cities, the driver may prepare himself for the license examination. After the driver has passed the examination, he pays an annual license fee, generally ranging from 50 cents to $5.

Although formal education is seldom required, many companies prefer applicants for a taxi driving job to have at least an eighth-grade education. A neat, well-groomed appearance is desirable, as is the ability to deal tactfully and courteously with all types of people. Good eye-hand-and-foot coordination is desirable because taxi drivers often must operate their cabs in fast moving and heavy traffic.

Opportunities for advancement for taxi drivers are extremely limited. Promotion to the job of dispatcher is often the only possible advancement. Some drivers, however, have become road supervisors, garage superintendents, or claims agents. Many drivers who work for companies try to purchase their own cabs so that they can become their own employers. In some large cities, however, the number of cabs is restricted by ordinances, which may limit the opportunity to own cabs in such areas.

Employment Outlook

There will be many opportunities for new workers to become taxi drivers throughout the 1970's, primarily because of the high turnover in this occupation. The number of taxi drivers has been slowly declining during the past decade, and this trend is expected to continue through the 1970's.

In the past, the employment of taxi drivers has been affected adversely by the increased use of privately owned automobiles, rented cars, and the continuing population shift to the suburbs where most people drive their own cars.

The high turnover in this occupation results from the lack of assurance of a steady income, the long hours, and the stopgap nature of this employment for some workers when better jobs are not available. Transfers from this occupation are expected to be the major reason that employment opportunities will be available for many new workers who wish to enter this field of driving.

Earnings and Working Conditions

Most taxi drivers employed by taxicab companies are paid a percentage—usually between 40 and 50 percent—of the total fare. Drivers also frequently receive tips, ranging from 10 to 20 percent of the fare. In 1970 many taxicab drivers earned between $2.00 and $3.00 an hour, including tips. Some taxi drivers covered by union-employer contracts have guaranteed minimums up to $60 or $70 a week.

Many drivers rent their cabs from the company by the day for a set price. Any receipts above the cab rental and other operating expenses are retained by the drivers.

A large percentage of full-time taxi drivers work 9 or 10 hours a day for 6 days a week. They usually begin work between 6 a.m. and 8 a.m. Many drivers work nights, starting between 3 p.m. and 5 p.m. Some drivers work on Sundays and holidays.

Many college students have been able to work their way through school by driving cabs on a part-time basis and during summer and spring holidays. Some workers also become part-time drivers to supplement their regular income.

Driving a taxicab is not physically strenuous. Most drivers do not change tires or do other heavy repair work. Drivers, however, are subject to nervous tension from driving in heavy traffic in all kinds of weather, and dealing with different types of passengers.

Many drivers find the lack of direct supervision by an employer one of the more desirable aspects of their job. However, they may be subject to municipal regulations which govern their personal appearance, the fares they charge, and their driving practices.

Taxi drivers in many of the large cities belong to labor unions, particularly those drivers who work for the large taxicab companies. The main union in this field is the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.).

Taxi drivers usually work long hours and do not receive overtime pay. Many of them do not receive fringe benefits, such as pensions and severance pay, that workers in many other occupations receive. When economic conditions decline, their earnings generally are reduced because of increased competition for less business.

FORGE SHOP OCCUPATIONS

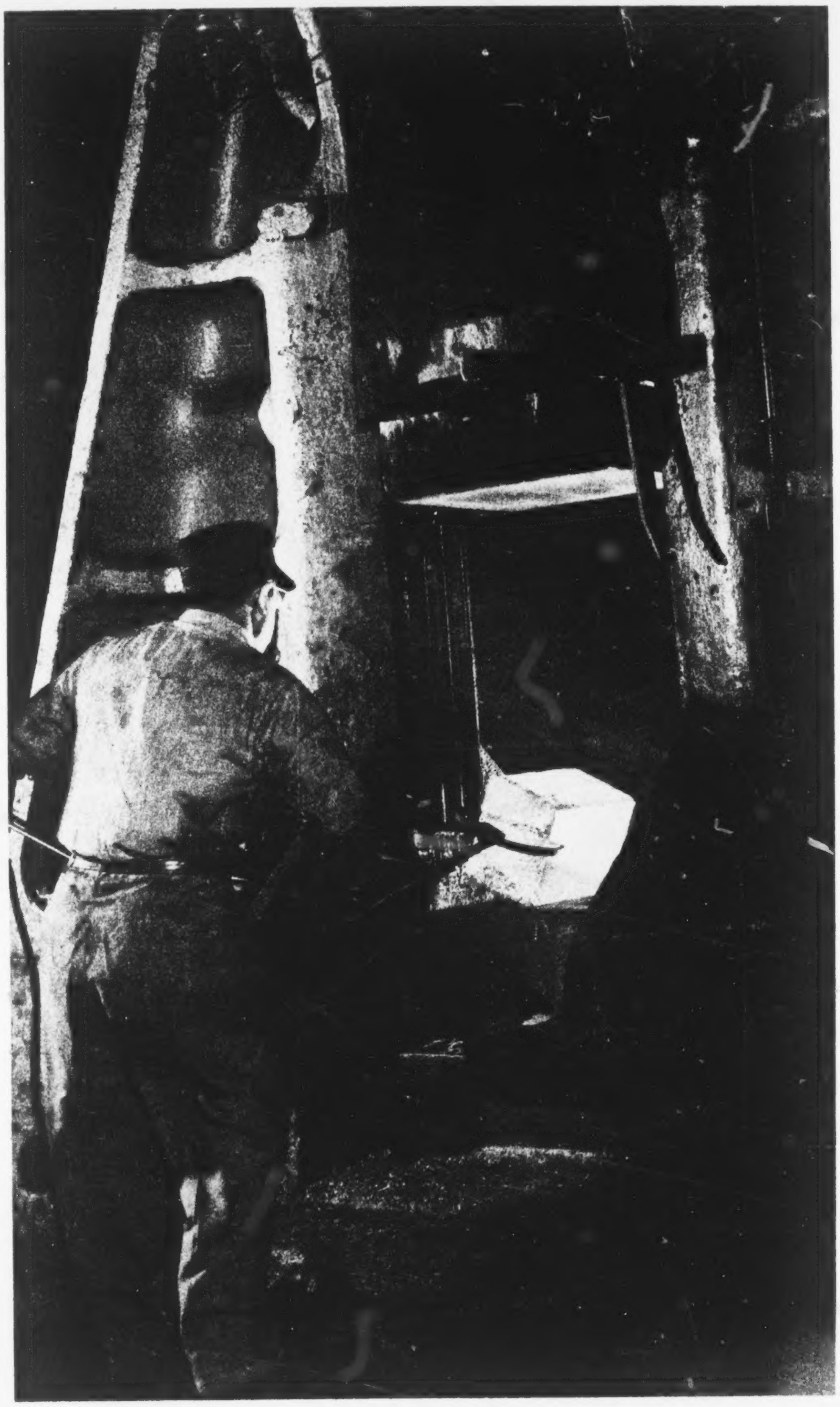
For centuries, blacksmiths have been forging, one of the principal methods of working and shaping metals. The modern forge shop, by substituting heavy power equipment and precision die blocks for the blacksmith's hand hammer and anvil, can do the work much more rapidly and accurately.

Forged metal is exceptionally strong and is used for many products that must withstand great stress. Examples of forged products include automobile crankshafts, gears, wrenches, scissors, and many aircraft, missile, and spacecraft parts. The great bulk of forging tonnage is made of steel, but aluminum, brass, bronze, copper, titanium, beryllium, and most other metals also are forged. Forgings range in weight from fractions of a pound to many tons.

This chapter describes the major kinds of forging production occupations; it does not discuss machining, maintenance, custodial, or other workers who are employed in forge shops but who are not directly engaged in the forging process. (For a detailed description of the duties, working conditions, and job prospects for blacksmiths, who do work similar to that of many forge shop workers, see the statement on Blacksmiths.)

Nature of the Work

Before metal can be shaped by hammers and presses, workers known as heaters must first heat it in intensely hot furnaces. Then drop hammer operators, hammersmiths, press operators, upsetter operators, and other workers manipulate the glowing hot metal between a pair of metal forms, called dies, that are attached to power hammers or presses. The hammers or presses pound or squeeze the metal with tremendous force to form it into the shape desired. Finally, trimmers, grinders, and other workers remove rough edges and excess metal from



forgings, and perform other finishing operations.

Two kinds of dies are used for forging—the impression (closed) die, which has a cavity shaped to the form of the metal part to be forged, and the open die, which is flat and more closely resembles the blacksmith's hammer. Impression dies are used where the need for large quantities of identical forging (for example, automobile crankshafts) justifies their expense. Open dies are used to produce relatively small numbers of forged parts, or to forge objects too large for impression dies.

The basic equipment used by forge shop workers consists of various types of power hammers, power forming and trimming presses, dies, and furnaces. They also use handtools, such as hammers and tongs, and measuring devices, such as calipers, scales, and rules. A forging hammer or press generally is operated by a crew of from 2 to 10 men. The number of men in the crew depends on the size and type of equipment operated and the size and shape of the part to be formed. Crews may specialize in the operation of a particular kind of hammer or press. The work performed by workers in the major forge shop occupations is as follows:

Hammersmiths (D.O.T. 612.381) supervise the operation of open-die power hammers that pound pieces of hot metal, called blanks or stock, into desired shapes. The precision of parts forged with such equipment is greatly dependent on the skill of the hammersmith. He must interpret blueprints, drawings, and sketches to determine how to work the metal under the hammer and determine the force of the hammer so that the piece being forged will be shaped to specifications. He also must decide whether the metal needs additional heating and when and how to use various forming tools under the hammer to produce angles and curves.

The hammersmith supervises a crew consisting of a hammer driver, or hammer runner, who operates controls of the hammer to regulate the force of the forging blow; a craneman, who transfers metal blanks from furnace to hammer and manipulates metal under the hammer; a heater, who heats metal to correct forging temperatures; and one or more helpers.

Hammer operators (D.O.T. 610.782), often called hammermen, are skilled forgemen who operate impression-die power hammers. Generally, the larger the hammer and the larger or more intricate the shape of the metal object to be formed, the greater the skill required of the operator. With the assistance of helpers and heaters, the hammerman sets and aligns dies in the hammer. He controls the force of the forging blow, manipulates metal under the hammer, and determines whether the metal needs additional heat.

Press operators (D.O.T. 611.782 and .885) operate huge presses equipped with either open or impression dies. Their work differs from that of the hammersmith or hammer operator mainly in that they shape and form hot metal by pressing or squeezing rather than by hammering or pounding. They must know how to regulate the pressure of their machines and position metal stock between the dies. In some cases, operators need to know how to control the heating of metal. Their duties also may include setting up dies in the presses.

Skills of open-die press operators are similar to those of hammersmiths. Both types of workers manipulate metal blanks between two open dies; both must be able to understand blueprints, drawings, or sketches in order to transform heated metal into finished forgings; and both may supervise crews composed of an assistant operator, a craneman, a heater, and several helpers.

Impression-die press operators work to more exacting specifications than press operators using open dies, but do not need as much manipulating skill because the die impression determines the shape of the forging. The impression-die press operator may supervise a small crew or work alone.

Upsetters (D.O.T. 611.782), also called upsettermen, operate machines that shape hot metal by applying pressure through the horizontal movement of one impression die against another. With the help of a heater and several helpers, the upsetter performs such duties as alining dies, positioning metal stock between the dies, adjusting the machine's pressure on the metal stock, and controlling the heating of the metal. Deep-socket wrenches, aircraft engine cylinders, bolts, and valves are examples of products made on upset machines.

Heaters (D.O.T. 619.782) control the supply of fuel and air in furnaces to obtain the temperature and atmosphere required for the metal being forged. Temperature gauges and observation of the metal's color help the heater determine when the correct temperature has been reached. Heaters use tongs or mechanical equipment to transfer heated metal from the furnace to the hammer or press. They also keep furnaces clean.

Inspectors (D.O.T. 612.281) check forgings for size, shape, quality, and other specifications. Some inspectors examine forged pieces for flaws and faulty workmanship while the forgings are still hot; others inspect forgings after they have been trimmed and cleaned. Inspection may be done visually and/or with gauges, micrometers, calipers, and other measuring devices. Checking for flaws also may be done with machines that test strength and hardness, and with magnetic and electronic testing devices.

Die sinkers (D.O.T. 601.280) are highly skilled workers who make the impression dies used on forging hammers and presses. Working from a blueprint, template, or drawing, a die sinker traces the outline of the object to be forged on two matched blocks of steel. He then forms the shape of this object in the steel die blocks by using milling machines and other machine tools such as EDM (electric discharge machinery) and ECM (electro chemical machinery). He uses scrapers, hand grinders, and other handtools to smooth and finish the die cavity. Finally, by using the completed dies, he makes a sample cast of the finished cavity, and checks all measurements with a micrometer and other precision instruments.

Many forge shop workers clean and finish forgings. For example, *trimmers* (D.O.T. 617.885) remove excess metal with presses equipped with trimming dies. *Grinders* (D.O.T. 705.884) remove rough edges with mechanically powered abrasive wheels. *Sandblasters* and *shotblasters* (D.O.T. 503.887) operate sandblasting or shotblasting equipment to clean and smooth forgings. *Picklers* (D.O.T. 503.885) dip forgings in an acid solution to remove surface scale and reveal any surface defects. *Heat treaters* (D.O.T. 504.782) heat and cool forgings to attain certain desired conditions or properties in the metal, such as hardness.

Places of Employment

Approximately 65,000 production workers were employed in forge shops in 1970. Nearly three-fourths of these workers were employed in independent shops—those that produce forgings for sale. The remainder worked in forging departments of plants that use forgings in their final products, such as automobiles, farm machinery, handtools, and structural and ornamental metal products.

Employment of forge shop workers is concentrated mainly in Ohio, Wisconsin, Michigan, Illinois, Indiana, Pennsylvania, Massachusetts, California, and New York. Forge shops usually are located near steel producing centers, which provide steel for forgings, as well as near metalworking plants, which are the major users of forged products.

Training, Other Qualifications, and Advancement

Most forge shop workers learn their skills through on-the-job training and work experience. They generally join a hammer or press crew as a helper, or, in some plants, as a heater. As they acquire experience, they progress to more skilled jobs. Advancement to the skilled job of hammersmith, for example, requires several years of on-the-job training and experience.

A few forge shops offer apprentice training programs for crafts such as die sinker, heat treater, hammer operator, hammersmith, and press operator. The programs, which generally last 4 years (in the case of die sinkers, from 4 to 8 years), give the apprentice a combination of classroom training and practical experience in using the tools and equipment of the trade. For example, hammersmith apprentices learn about the properties of metals and how to operate power hammers and furnaces, use handtools and welding equipment, and read blueprints.

Training requirements for inspectors vary. Those who inspect rough forgings visually or with simple gauges usually can perform their jobs after only a few weeks of on-the-job training. Those who examine parts forged to more exact specifications and operate more complicated testing equipment may need some technical background in blueprint reading and mathematics and may be given several months of on-the-job training.

Employers usually require no more than a grammar school education for helpers and heaters, but high school graduates are preferred. Young men interested in the more skilled forge shop jobs should complete high school and include mathematics (especially geometry), drafting, and shopwork in their studies.

Because forge shop work sometimes involves lifting and moving heavy forgings and dies, workers must be strong. However, cranes are used for moving very large objects. Forge shop workers must have the stamina to work under hot and noisy conditions.

Employment Outlook

Production worker employment in forge shops is expected to increase slowly through the 1970's. Most job openings will arise from the need to replace experienced workers who retire, die, or transfer to other fields of work.

Employment is expected to increase because industries that use forgings in their final products—particularly the industrial machinery and automobile industries—will expand as the Nation's general economic activity rises. However, employment is expected to increase more slowly than forge shop production because continued improvements in forging techniques and equipment and more efficient plant operations will result in greater output per worker. Forge shop employment has been sensitive to changes in general business conditions, and it is expected that substantial year-to-year changes in the level of employment will continue.

Earnings and Working Conditions

Average earnings of forge shop production workers are higher than those for manufacturing production workers as a whole. In 1970, production workers in iron and steel forging plants earned an average of $172.40 a week, or $4.31 an hour, compared with average weekly earnings of $133.73, or $3.36 an hour, for production workers in all manufacturing industries.

Collective bargaining contracts negotiated between employers and unions provide for various fringe benefits, such as holiday pay, vacation pay, and retirement pensions. Most union-management agreements provide for 8 or 9 paid holidays a year and up to 5 weeks' vacation, depending on length of service. Other important provisions include life insurance benefits financed by the employer, as well as accident and sickness, hospital, and surgical benefits.

Working conditions in forge shops have improved in recent years. Many firms have installed heat deflectors and ventilating fans to reduce heat and smoke and have attempted to reduce machine concussion, noise, and vibration. Although the rate of disabling work injuries in forge shops is higher than the average for all manufacturing, employers and unions attempt to eliminate injuries by promoting safety training and the use of protective equipment, including face shields, ear plugs and muffs, safety glasses, metal-toe shoes, instep guards, metal helmets, and machine safety guards.

Most forge shop workers are union members. Many are members of the International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers. Others are members of the United Steelworkers of America; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Association of Machinists and Aerospace Workers; and the International Die Sinkers' Conference (Ind.).

Sources of Additional Information

Further information on employment opportunities in forging can be obtained from local offices of the State employment service; personnel departments of individual forge shops; locals of the labor unions noted above; and from:

The Forging Industry Association, 55 Public Square, Cleveland, Ohio 44113.

Open Die Forging Institute, 440 Sherwood Rd., La Grange Park, Ill. 60525.

MACHINING OCCUPATIONS

Almost every product made by American Industry contains metal parts or is manufactured by machines made of parts. Many of these metal parts are shaped to precise dimensions by skilled and semiskilled machining workers who use a wide variety of machine tools. Machining workers make up the largest single occupational group in the metalworking trades. In 1970, about 1.2 million workers were employed as machinists, tool and die makers, instrument makers, machine tool operators, and setup men.

Nature of the Work

The principal job of most machining workers is to operate machine tools. A machine tool is a stationary, power-driven machine that holds both the piece of metal to be shaped and a cutting instrument, or "tool," and brings them together so that the metal is cut to the desired shape. In some cases, the cutting tool is moved, and the metal is held stationary; in others, the metal is moved against a stationary tool.

The most common types of machine tools are lathes, grinding machines, drilling and boring machines, milling machines, shapers, broachers, and planers. Lathes turn and shape metal against a sharp cutting tool. Grinding machines smooth metal parts by means of power-driven abrasive wheels. Drilling machines make holes in metal. Boring machines enlarge holes already drilled. Milling machines cut or remove excess metal with tools that have several cutting edges. Shapers, planers, and broachers are machine tools that produce flat surfaces. In addition to these common machining methods, several new metal shaping techniques have been introduced in recent years. For example, metal can now be shaped using chemicals, electricity, magnetism, sound, light, and liquids under controlled conditions.

Accuracy is of prime importance for most machining work. Motors, farm machinery, and typewriters are included among the wide variety of products made of metal parts that must be made to precise dimensions so that they are interchangeable and can be easily assembled for mass-production purposes. Metal parts sometimes are machined to tolerances of 10 millionths of an inch. Machining workers follow directions generally given in the form of a drawing or blueprint, upon which exact dimensions of the finished part are specified; some instructions may be less detailed. Machining workers frequently use micrometers and other precision-measuring instruments to check the accuracy of their work against the required specifications.

In addition to operating machine tools, skilled tool and die makers, instrument makers, and machinists spend a considerable portion of their time doing precision handwork, such as laying out and assembling metal parts. After the separate parts have been machined, they use files, scrapers, emery cloths, and miscellaneous small handtools in filing, scraping, and polishing the parts for exact fit in the final assembly.

All-round machinists are skilled workers who can operate most types of machine tools. Machine tool operators commonly operate only one kind of machine tool. Tool and die makers specialize in making dies for use with presses and diecasting machines, devices to guide drills into metal, and special gages to determine whether the work meets specified tolerances. Instrument makers use machine tools to produce highly accurate instrument parts made of metal or other materials. Setup men adjust machine tools so that semiskilled machine tool operators can run the machines. (Detailed discussions of the types of work performed by workers in each of these machining occupations are presented later in this chapter.)

Since continuous attention is required when machine tools are in operation, the work may be tedious, especially on simple and repetitive machining jobs. However, where the work is varied and complex and standards of accuracy high, a worker may experience the satisfaction that comes to a capable and conscientious craftsman in a highly skilled trade.

Location of Machining Work

An estimated 530,000 machinists; 425,000 machine tool operators; 165,000 tool and die makers; 70,000 setup men; and 8,000 instrument makers were employed in 1970. About four-fifths of all machining workers were employed in the metal-working industries, mostly in the machinery, except electrical; transportation equipment; fabricated metal products; and electrical machinery and equipment industries. Many thousands also were employed in repair shops of railroads and maintenance shops of factories that make textiles, paper, glass, or chemicals. A small number worked in research laboratories and shops that fabricate models of new products.

Machining workers are employed in every State and in almost every city in the country. However, more than half of all machining workers are employed in California, Ohio, New York, Michigan, Illinois, and Pennsylvania. Other States having large numbers of machining workers are New Jersey, Massachusetts, Indiana, Connecticut, Wisconsin, and Texas. Most instrument makers are employed in New York City, Chicago, and a few other large cities.

Training, Other Qualifications, and Advancement

The common method of entering skilled machining occupations is through apprenticeship—a period of formal on-the-job training during which the new worker learns all the aspects of his trade. He is taught to operate machine tools and to use handtools and measuring instruments. In addition to shop training, the apprentice is given classroom instruction in blueprint reading, mathematics, and related subjects. In choosing apprentices, employers usually prefer young men who have a high school or trade school education. Some companies use aptitude tests to help determine whether applicants for machining jobs have the necessary mechanical ability and the temperament to perform this exacting work. Machining workers also must have good vision and superior judgment of depth and distance.

Most semiskilled machine tool operators—and some machinists, tool and die makers, and instrument makers—"pick up" the skills of their trade informally through experience on several jobs. They generally start in the less skilled machining jobs working under the supervision of experienced craftsmen. They gradually advance to more skilled jobs as they acquire experience and knowledge. Some workers improve their skills and increase their chances for advancement by taking courses in blueprint reading, electronics, hydraulics, and shop mathematics. An increasing number of machining workers are participating in intensive training programs provided by machinery manufacturers or sponsored by labor unions. Some of these programs train machining workers to maintain and repair numerically controlled machine tools.

Programs to train unemployed and underemployed workers, primarily for entry jobs in the machining occupations, were operating in many cities in 1970 under the Manpower Development and Training Act. The majority of these programs, which continue up to a year, were for machine tool operators, but some were for other machining occupations. The programs stressed the fundamentals of machine tool operation. Graduates of these programs may eventually become skilled machining workers by gaining additional training and experience.

Although women sometimes are employed as machine tool operators, relatively few are employed in skilled machining occupations.

Machining workers have several advancement opportunities. For example, many can advance to foremen. Individuals having extensive machine shop experience may, with specialized training, become programers who prepare the coded paper tapes used to operate numerically controlled machines. Tool and die makers and instrument makers can advance to technical positions such as tool and die designer or instrument technician. Machining workers also can open their own tool and die shops or machine shops.

Employment Outlook

There will be thousands of job openings for machining workers through the 1970's. Most of these openings will result from the need to replace experienced workers who transfer to other fields of work, retire, or die. Replacement needs will be a particularly important factor in the skilled machining occupations, which have a relatively high proportion of older workers. Transfers of semiskilled machine tool operators to other occupations are fairly common, and some openings also will result from these transfers. Other openings are expected to result from the anticipated slow increase in the demand for these workers, assuming the realization of relatively full employment nationally and high rates of economic growth necessary to achieve this goal.

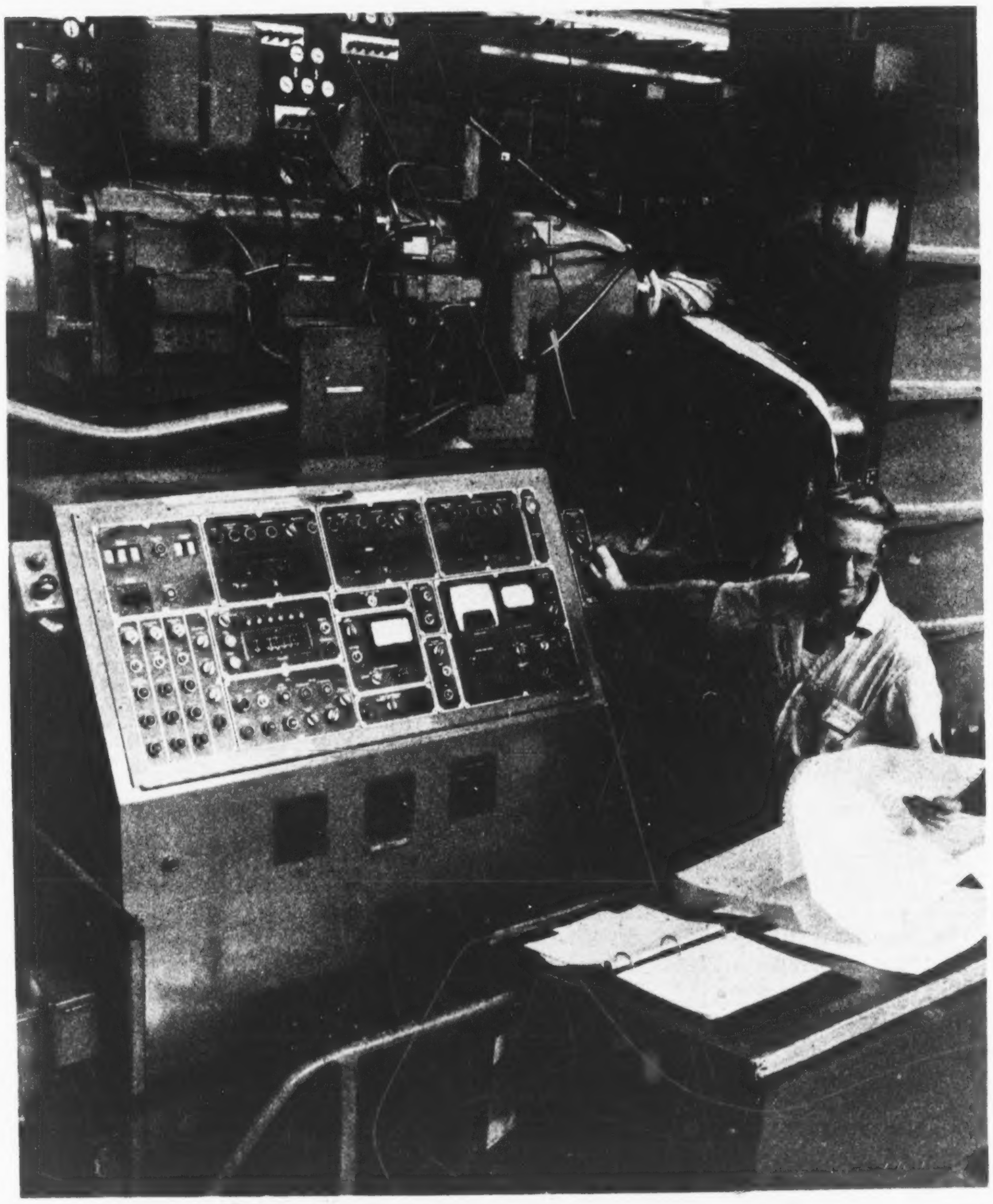
Employment in the various machining occupations is expected to increase at different rates. For example, the number of instrument makers is expected to increase rapidly, whereas little or no change is expected in the employment of machine tool operators. Laborsaving technological changes are expected to slow the employment growth of most machining occupations.

The anticipated increase in the employment of machining workers is expected to result from the rapid rise in the demand for machined products. Increases in population and in the number of households, plus higher levels of personal disposable income, are expected to result in a large increase in the demand for consumer products, such as automobiles, heating and air-conditioning equipment, and household appliances, in the production of which machining is involved. Higher levels of corporate income and rising expenditures for industrial plant capacity should stimulate the demand for machine tools, engines, pumps, instruments, and other industrial equipment.

Employment of machining workers is not expected to expand as fast as the demand for machined products because technological developments will increase output per worker. For example, automated machining lines, in which machine tools are linked together for production operations, are being used increasingly. The cutting and feeding speeds of machine tools also are increasing. New processes that will be used more frequently in the future for metal removal include chemical and electrical milling, electrical discharge and ultrasonic machining, and machining by electron beams and lasers. The use of powdered metals and advances in metal forming, both of which significantly reduce the amount of machining necessary to produce a final product, also may gain more widespread application in the future.

Of all the technological changes that are expected to affect the future employment of workers in machining occupations, the greatest impact is expected to arise from the expanding application of numerically controlled machine tools. The use of numerically controlled machine tools broadly involves the following sequence of operations: Engineers or draftsmen translate part dimensions and tolerances, cutter shapes and sizes, cutting paths and sequences, and other data into numbers or codes representing numbers. These numbers are punched on tapes or cards which are inserted into electronic or mechanical devices that translate numbers into motions or actions, such as drilling or cutting. The machine tool operator simply installs the tool, inserts and removes the work-piece, and changes the tapes or cards.

The growing use of numerically controlled machine tools will limit the employment growth of some machining workers, particularly semiskilled operators. On the other hand, the more sophisticated applications of these machine tools will require some operators to have greater skill and knowledge of machining operations.


Numerically controlled machines increase efficiency of machine workers.

Earnings and Working Conditions

The earnings of skilled machining workers compare favorably with those of other skilled industrial workers. Tool and die makers and instrument makers are the highest paid workers in the machining group and are among the highest paid skilled workers in manufacturing. Earnings information for the individual machining occupations is presented later in this chapter.

Most machine shops are relatively clean and well lighted. Because they work with high speed machine tools and sharp cutting instruments, workers in these occupations need good safety habits. Persons working around machine tools are prohibited from wearing loose fitting clothing. They frequently wear safety glasses and other protective equipment.

Machining work usually is not physically strenuous. The machine tools do the actual cutting while the machining worker sets the machine, watches the controls, and checks the accuracy of the work. The workers, however, usually stand at their jobs most of the day and move about frequently.

Companies that employ machining workers generally provide paid holidays and paid vacations. Life insurance, hospitalization, medical and surgical insurance, sickness and accident insurance, and pensions also are often provided.

The great majority of workers in machining occupations are members of unions. Among the labor organizations in this field are the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Union of Electrical, Radio and Machine Workers; the International Brotherhood of Electrical Workers; the United Steelworkers of America; and the Mechanics Educational Society of America.

Sources of Additional Information

The National Machine Tool Builders Association, 2139 Wisconsin Ave. NW., Washington, D.C. 20007—whose members build a large percentage of all machine tools used in this country—will, on request, supply information on career opportunities in the Machine Tool Industry.

The National Tool, Die and Precision Machining Association, 1411 K St. NW., Washington, D.C. 20005, offers information on apprenticeship training, including Recommended Apprenticeship Standards for Tool and Die Makers, certified by the U.S. Department of Labor's Bureau of Apprenticeship and Training.

Many State employment service local offices provide free aptitude testing to persons interested in becoming all-round machinists or tool and die makers. The State employment service also may be a source of information about training opportunities under the Manpower Development and Training Act. In addition, the State employment service refers applicants for apprentice programs to employers. In many communities, applications for apprenticeship also are received by labor-management apprenticeship committees.

Apprenticeship information also may be obtained from the following unions (which have local offices in many cities):

International Association of Machinists and Aerospace Workers, 1300 Connecticut Ave. NW., Washington, D.C. 20036.

International Union, United Automobile, Aerospace and Agricultural Implement Workers of America, 8000 East Jefferson Ave., Detroit, Mich. 48214.

International Union of Electrical Radio and Machine Workers, 1126 16th St. NW., Washington, D.C. 20036.

International Brotherhood of Electrical Workers, 1200 15th St. NW., Washington, D.C. 20005.

ALL-ROUND MACHINISTS

(D.O.T. 600.280 and .281)

Nature of the Work

The all-round machinist is a skilled worker who uses machine tools to make metal parts. A machinist can set up and operate most types of machine tools. His wide knowledge of shop practice and the working properties of metals, plus his understanding of what the various machine tools can accomplish, enable him to turn a block of metal into an intricate part meeting precise specifications.

Variety is the main characteristic of the work of an all-round machinist. He plans and carries through all operations needed in turning out machined products. He may switch frequently from the production of one kind of product to another. An all-round machinist selects the tools and material required for each job and plans the cutting and finishing operations in order to complete the finished work according to blueprint or written specifications. He makes standard shop computations relating to dimensions of work, tooling, feeds, and speeds of machining. He often uses precision-measuring instruments, such as micrometers and gages, to measure the accuracy of his work to thousandths or even millionths of an inch. After completing machining operations, he may finish the work by hand, using files and scrapers, and then assemble the finished parts with wrenches and screwdrivers. The all-round machinist may also "heat treat" cutting tools and parts to improve machinability.

Machinists employed in maintenance departments to make or repair metal parts of machines and

Machinist drills to close tolerance.

equipment also have a broad knowledge of mechanical principles. They sometimes adjust and test the parts they have made or repaired for a machine.

In plants that produce large numbers of metal products, some highly skilled machinists specialize in layout work. These specialists (layout men) mark specifications on metal so that machine tool operators can perform the proper machining operations.

Places of Employment

Almost every factory using a substantial amount of machinery employs all-round machinists to keep its mechanical equipment operating. Some all-round machinists work in the production departments of metal-working factories where large quantities of identical parts are produced; others work in machine shops where a limited number of varied products are made. Most all-round machinists work in the following industries: Machinery, including electrical; transportation equipment; fabricated metal products; and primary metals. Among the other industries employing substantial numbers of these workers are the railroad, chemical, food processing, and textile industries. The Federal Government also employs all-round machinists in Navy yards and other installations.

An important advantage of this occupation is that machinists can be employed in almost every locality and industry because their skills are required to maintain all types of machinery.

Training, Other Qualifications, and Advancement

According to most training authorities, a 4-year apprenticeship is the best way to learn the machinist trade. Many machinists, however, have qualified without an apprenticeship by learning the trade through years of varied experience in machining jobs. Some companies have training programs which qualify some of their employees as machinists in less than 4 years.

A young person interested in becoming a machinist should be mechanically inclined and temperamentally suited to do highly accurate work that requires concentration as well as physical effort. A high school or vocational school education, including courses in mathematics, physics, or machine shop training, is desirable. Some companies require their experienced machinists to take additional courses in mathematics and electronics at company expense, so that they can service and operate the numerically controlled machine tools coming into greater use. In addition, equipment builders generally provide training in the electrical, hydraulic, and mechanical aspects of machine-and-control systems.

A typical machinist apprentice program lasts 4 years and consists of approximately 8,000 hours of shop training and about 570 hours of related classroom instruction. Shop training includes learning the operation of various types of machine tools. The apprentice also is taught chipping, filing, hand tapping, dowel fitting, riveting, and other hand operations. In the classroom, the apprentice studies blueprint reading, mechanical drawing, shop mathematics, and shop practices.

Numerous promotional opportunities are available to all-round machinists. Many advance to foreman of a section or to other supervisory jobs. Others who receive additional training may become tool and die makers or instrument makers. A skilled machinist has excellent opportunities to advance into other technical jobs in machine programing and tooling. Machinists also can open their own machine shops.

Employment Outlook

The number of all-round machinists is expected to increase slowly through the 1970's, as a result of the anticipated expansion of metalworking activities. (See discussion, p. 450.) However, most job openings will arise from the need to replace experienced machinists who transfer to other fields of work, retire, or die.

Much of the employment growth will occur in maintenance shops, as industries continue to use a greater volume of complex machinery and equipment. Skilled maintenance machinists are needed to prevent costly breakdowns in highly mechanized plants where machine tools often are linked together by transfer equipment. In such plants, a breakdown of one machine may stop many other machines.

Earnings and Working Conditions

The earnings of all-round machinists compare favorably with those of other skilled factory workers.

Maintenance machinists employed in various industries in 77 metropolitan areas surveyed in 1969–70 received average straight-time hourly earnings ranging from $2.89 in Greenville, S.C., to $4.86 in Detroit, Mich. Average straight-time hourly earnings of maintenance machinists employed in the following cities were:

Atlanta	$4.03
Birmingham	4.22
Chicago	4.49
Cincinnati	4.14
Detroit	4.86
Greenville	2.89
Houston	4.38
Los Angeles–Long Beach	4.53
Memphis	3.86
Milwaukee	4.76
Minneapolis–St. Paul	4.44
New York	4.47
Portland, Oreg.	4.50
Rockford, Ill.	3.85
San Francisco–Oakland	4.75
Worcester	3.85

Machinists must follow strict safety regulations when working around high-speed machine tools. The greater use of safety glasses and other protective devices in recent years has reduced the accident rate for these workers.

See introductory section of this chapter for a discussion of nonwage benefits received by machining workers, unions that organize these workers, and sources of additional information.

MACHINE TOOL OPERATORS

(D.O.T. 600.280; 601.280; 602.280 through .885; 603.280 through .885; 604.280 through .885; 605.280 through .885; and 606.280 through .885)

Machine tool operators shape metal to precise dimensions by the use of machine tools. Most operators can operate only one or two types of machine tools; some can operate several. Many operators are semiskilled machine tenders who perform simple, repetitive operations that can be learned quickly. Other operators, however, are skilled workers who can perform complex and varied machining operations.

A typical job of a semiskilled operator is to place rough metal stock in a machine tool on which the speeds and operation sequence have already been set by a skilled worker. The operator watches the machine and calls his supervisor when it is not functioning correctly. Special, easy-to-use gages help him to measure the work quickly and accurately. The operator who has limited training may make minor adjustments to keep his machine tool operating, but he depends on skilled machining workers for major adjustments.

Machine tool operator positions multiple spindle drilling machine.

The work of skilled machine tool operators usually is limited to a single type of machine and involves little or no hand fitting or assembly work. He plans and sets up the correct sequence of machining operations according to blueprints, layouts, or other instructions. He adjusts speed, feed, and other controls, and selects the proper cutting instruments or tools for each operation. He must be able to use all the special attachments of his machine because adjustments during machining operations and changes in the setup may be required. Upon completing his work, he measures tolerance limits with micrometers, gages, and other precision-measuring instruments to see whether the work meets specifications. The skilled machine tool operator also may select cutting and lubricating oils used to cool metal and tools during machining operations.

Lathes, drill presses, boring machines, grinding machines, milling machines, and automatic screw machines are among the machine tools used by machine operators. Both skilled and semiskilled operators have job titles related to the kind of machine they operate, such as engine lathe operator, milling machine operator, and drill press operator.

Places of Employment

Machine tool operators are employed mainly in factories that manufacture fabricated metal products, transportation equipment, and machinery in large quantities. Skilled machine tool operators work in production departments, maintenance departments, toolrooms, and job shops. Because of their limited training, few semiskilled operators work in maintenance departments or in job shops.

Training, Other Qualifications, and Advancement

Most machine tool operators learn their skills on the job. A beginner usually starts by observing a skilled operator at work. When the learner first operates a machine, he is supervised closely by a more experienced worker. The beginner learns how to use measuring instruments and to make elementary computations needed in shop work. He gradually acquires experience and learns to operate a machine tool, read blueprints, and plan the sequence of machining work.

Individual ability and effort largely determine how long it takes to become a machine tool operator. Semiskilled machine tool operators generally learn their jobs within a few months. However, it usually takes 1½ to 2 years of on-the-job training and experience to become a skilled machine tool operator. Some skilled machine tool operators' jobs are filled by men who have completed machinists' apprenticeships. Some companies have formal training programs to acquaint new employees with the details of machine tool operation and machining practice.

Although there are no special educational requirements for semiskilled operator jobs, young persons seeking such jobs can improve their job opportunities by completing courses in mathematics and blueprint reading. In hiring beginners, employers often look for persons who have mechanical aptitude and some experience working with machinery.

Skilled machine tool operators can advance to jobs as all-round machinists and tool and die makers. They also may advance to jobs in machine programing and maintenance.

Employment Outlook

The number of machine tool operators is expected to show little change through the 1970's, despite the anticipated expansion of metalworking activities. (See discussion, p. 450.) However, tens of thousands of workers will be hired to replace experienced machine tool operators who transfer to other jobs, retire, or die.

Technological developments will continue to affect both the number and skill requirements of machine tool operators. The use of faster and more versatile automatic machine tools and the increasingly widespread use of numerically controlled machine tools will result in greater output per worker and tend to limit employment growth. (For the role of numerically controlled machines, see the discussion in the introductory section of this chapter under "Employment Outlook.") Other factors that may contribute to the slow growth in this occupation are the new processes that are becoming increasingly important in metal removal, such as chemical milling, electrical milling, electrical discharge and ultrasonic machining, and machining by electron beams and lasers. Advances in metal forming and the use of powdered metals also may limit employment growth since they reduce the amount of machining necessary to produce a final product.

Workers who have thorough backgrounds in machining operations, mathematics, blueprint reading, and a good working knowledge of the properties of metals will be better able to adjust to the changing job requirements that will result from these technological advances.

Earnings and Working Conditions

Machine tool operators are paid hourly or incentive rates, or on the basis of a combination of both methods. In 40 selected metropolitan areas surveyed in 1969–70 machine tool operators received straight-time hourly earnings ranging from $3.33 in Green Bay, Wis., to $4.87 in Detroit, Mich. Average straight-time hourly earnings of machine tool operators employed in the following cities were:

Boston	$3.79
Buffalo	4.48
Chicago	4.38
Cincinnati	4.36
Cleveland	4.24
Dallas	3.37
Detroit	4.87
Green Bay	3.33
Houston	3.76
Los Angeles–Long Beach	4.32
Milwaukee	4.63
New York	3.81
Pittsburgh	4.02
Portland, Oreg.	3.96
St. Louis	4.44
San Francisco–Oakland	4.60
Worcester	3.42

Machine tool operators are required to wear protective glasses and to avoid wearing loose-fitting garments when working around high speed machine tools. Increasing emphasis upon these and other safety regulations has reduced the accident rate for these workers.

See introductory section of this chapter for a discussion of nonwage benefits received by machining workers, unions that organize these workers, and sources of additional information.

TOOL AND DIE MAKERS

(D.O.T. 601.280, .281, .380, and .381)

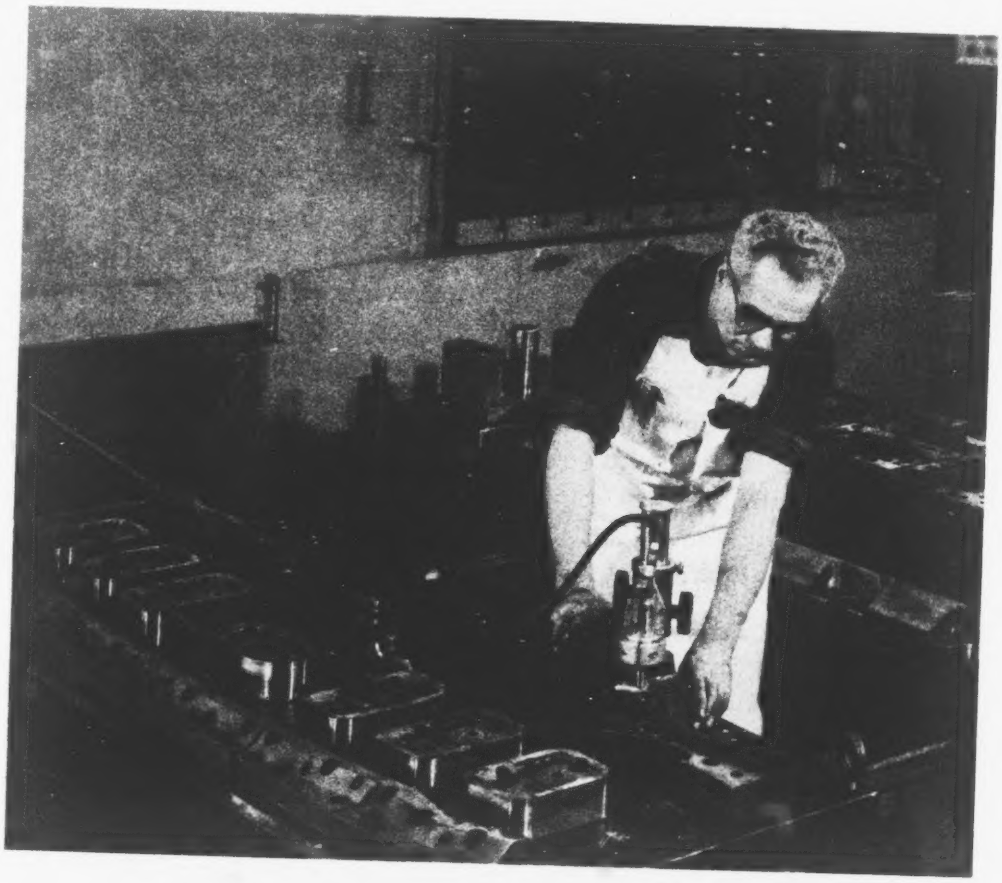
Nature of the Work

Tool and die makers are highly skilled, creative workers whose products—tools, dies, and special guiding and holding devices—are the basis of mass production in metalworking industries. Toolmakers specialize in producing jigs and fixtures (devices required to hold metal while it is being shaved, stamped, or drilled). They also make gages and other measuring devices that are used in manufacturing precision metal parts. Die makers construct metal forms (dies) which are used in stamping and forging operations to shape metal. They also make metal molds used in diecasting and in molding plastics. Tool and die makers also repair worn or damaged dies, gages, jigs, and fixtures. Some tool and die makers help design tools and dies.

In comparison with most other machining workers, tool and die makers have a broader knowledge of machining operations, shop practices, mathematics, and blueprint reading, and can work to closer tolerances and do more precise handwork. Tool and die makers use almost every type of machine tool and precision-measuring instrument. They work with all metals and alloys commonly used in manufacturing and must be familiar with the machining properties of these various metals.

Places of Employment

The largest numbers of tool and die makers are employed in plants producing manufacturing, construction, and farm machinery and equipment. The automobile, aircraft, and other transportation equipment industries also employ large numbers of tool and die makers. Several thousand of these



Tool and die maker finishes die with grinding wheel.

craftsmen work in small tool and die jobbing shops, making tools, dies, and other machine tool accessories for use in metalworking factories. Companies manufacturing electrical machinery and fabricated metal products are other important employers of tool and die makers. Many nonmetalworking industries also employ them.

Training, Other Qualifications, and Advancement

Tool and die making requires several years of varied training and experience which can be obtained through formal apprenticeship or equivalent on-the-job training. Since this work is highly skilled, persons planning to enter the trade should have a good working knowledge of mathematics and physics as well as considerable mechanical ability, finger dexterity, and an aptitude for doing very precise work. In selecting apprentices, most employers prefer young men who have a high school or trade school education. Some employers test apprentice applicants to determine their mechanical aptitudes and their abilities in mathematics.

A tool and die apprenticeship ordinarily lasts 4 or 5 years. Most of the time is devoted to practical shop training, which includes learning how to use the drill press, milling machine, lathe, grinder, and other machine tools. The apprentice also learns inspection work plus the use of handtools in fitting and assembling tools, gages, and other mechanical equipment. Tool and die maker apprentices study heat treating and other metalworking processes. Classroom training is becoming increasingly important and includes shop mathematics, shop theory, mechanical drawing, tool designing, and blueprint reading. After apprenticeship, several years' experience often is necessary to qualify for more difficult tool and die work. Some companies have separate apprenticeship programs for toolmaking and die making.

Many metal machining workers have become tool and die makers without completing formal apprenticeships. After acquiring years of experience as skilled machine tool operators or as machinists plus additional classroom training, these men have developed into all-round workers who can skillfully perform tool and die making.

The increasing complexity of modern machinery and metalworking equipment is raising the technical requirements for tool and die making. A knowledge of mathematics, the basic sciences, electronics, and hydraulics will give young persons entering this occupation greater opportunities to advance their careers.

Men who have had tool and die training often advance to supervisory and administrative positions in industry. Many tool and die makers become tool designers. Some open their own tool and die shops.

Employment Outlook

Employment of tool and die makers is expected to increase slowly through the 1970's. However, most job opportunities will become available as experienced tool and die makers transfer to other fields of work, retire, or die.

The anticipated long-range expansion in the machinery, electrical equipment, transportation equipment, and other metalworking industries will result in a continued need for tool and die makers to make the tools and dies used to produce the large numbers of identical metal parts required in these industries. They also will be needed to help put many technological developments into effect. However, the expanding use of electrical-discharge machines and numerical control machines has significantly changed tool making processes. Numerically controlled machining operations require fewer of the special tools and jigs and fixtures that are made by tool and die makers. In addition, numerically controlled machines could replace many of the conventional machines now used in manufacturing tools, jigs, and fixtures, thus increasing output per tool and die maker.

Tool and die makers, as a group, have a longer working life than many other workers in the labor force. Their jobs require extensive skill and knowledge that can be acquired only after many years of experience. For this reason, companies are reluctant to lay off tool and die makers, even when production is decreased. Tool and die makers also have greater occupational mobility than other less skilled workers. They can transfer to jobs as instrument makers or machinists.

Earnings and Working Conditions

Tool and die makers are among the highest paid machining workers. Those employed in various industries in 66 metropolitan areas surveyed in 1969–70 were paid average straight-time hourly earnings ranging from $3.45 in Chattanooga, Tenn., to $5.29 in San Francisco–Oakland and San Jose, Calif. Straight-time hourly earnings of tool and die makers employed in the following cities were:

Atlanta	$4.55
Baltimore	4.33

Birmingham	3.66
Boston	4.13
Buffalo	4.63
Chattanooga	3.45
Chicago	4.84
Cleveland	4.51
Dallas	4.26
Detroit	5.08
Houston	4.03
Los Angeles–Long Beach	4.71
Milwaukee	4.89
Minneapolis–St. Paul	4.48
Newark–Jersey City	4.36
New York	4.35
Philadelphia	4.19
St. Louis	4.86
San Francisco–Oakland	5.29
San Jose	5.29
Worcester	3.62

See introductory section of this chapter for a discussion of nonwage benefits received by machining workers, unions that organize these workers, and sources of additional information.

INSTRUMENT MAKERS (MECHANICAL)

(D.O.T. 600.280)

Nature of the Work

The expanding use of instruments in production, research, development, and testing work is making the work of the instrument maker increasingly important. Instrument makers (also called experimental machinists and modelmakers) work closely with engineers and scientists in translating designs and ideas into experimental models, special laboratory equipment, and custom instruments. They also modify existing instruments for special purposes. Experimental devices constructed by these craftsmen are used, for example, to regulate heat, measure distance, record earthquakes, and control industrial processes. The mechanical instrument parts and models made by these workers range from simple gears to intricate parts of navigation systems used in guided missiles.

Instrument makers fabricate metal parts by operating machine tools, such as lathes and milling machines, and by using handtools, such as files and chisels. Because accuracy is important, they measure finished parts with a wide variety of precision-measuring equipment, including micrometers, verniers, calipers, profilometers, and dial indicators, as well as standard optical measuring instruments.

Instrument makers work from rough sketches, verbal instructions, or ideas, as well as detailed blueprints. Thus, in making parts, they frequently use considerable imagination and ingenuity. Instrument makers sometimes work on parts that must not vary from specifications by more than ten millionths of an inch. To meet these standards,

Instrument maker constructs glass part for scientific instrument.

they commonly use special equipment or precision devices, such as the electronic height gage, which are used only infrequently by other machining workers. They also work with a variety of materials, including plastics and rare metals such as titanium and rhodium.

An instrument maker may construct instruments from start to finish—making and assembling all the parts and testing finished instruments for proper operation. However, in large shops or where electrical or electronic components are to be incorporated into an instrument, they frequently work with other instrument makers, such as electronic specialists, each making a part of a complicated instrument.

Because they usually work on their own and have highly developed manual skills and reasoning abilities, instrument makers have considerable prestige among their fellow employees.

Places of Employment

Many instrument makers are employed by firms which manufacture instruments. Research and development laboratories also employ instrument makers to make the special devices required in scientific research. The Federal Government employed several thousand instrument makers in 1970.

The main centers of instrument making are located in and around a few large cities, particularly New York, Chicago, Los Angeles, Boston, Philadelphia, Washington, Detroit, Buffalo, Cleveland, and Rochester.

Training, Other Qualifications, and Advancement

Some instrument makers advance from the ranks of machinists or skilled machine tool operators. These craftsmen, working at first under close supervision and doing the simpler jobs, usually need 1 to 2 years or more of instrument shop experience to qualify as instrument makers.

Most instrument makers learn their trade through apprenticeships which generally last 4 or 5 years. A typical 4-year instrument maker apprenticeship program consists of approximately 8,000 hours of shop training and about 570 hours of related classroom instruction. The apprentice's shop training emphasizes the use of machine tools, hand tools, and measuring instruments, and the working properties of various materials. Classroom instruction covers related technical subjects such as mathematics, physics, blueprint reading, chemistry, electronics, and fundamental instrument design. The apprentice must learn enough shop mathematics to plan his work and use handbook formulas. A basic knowledge of mechanical principles is needed in solving gear and linkage problems.

For apprenticeship programs, employers generally prefer high school graduates who have studied algebra, geometry, trigonometry, science, and machine shop work. Further technical schooling in electricity and electronics is often desirable, and may make possible future promotions to technician positions.

A person interested in becoming an instrument maker should have a strong interest in mechanical subjects and better-than-average ability to work with his hands. He must have initiative and resourcefulness because instrument makers often work alone and almost always under minimum or no supervision. Since the instrument maker often faces new problems, he must be able to develop original solutions. Frequently, he must visualize the relationship between individual parts and the complete instrument. He must understand the principles of the instrument's operation. Because of the nature of his work, the instrument maker has to be very conscientious and take considerable pride in creative work.

As the instrument maker's skill improves and as he broadens his knowledge, he may advance to increasingly responsible positions. Up to 10 years' experience is required to rise to the top skill level of instrument making. By gaining additional training beyond the high school level in subjects such as physics and machine design, some instrument makers may advance to technician jobs. In these jobs, they plan and estimate time and material requirements for the manufacture of instruments, or provide specialized support to professional personnel. Others may become supervisors and train less skilled instrument makers.

Employment Outlook

The employment of instrument makers is expected to increase rapidly through the 1970's, as a result of anticipated expansion of metalworking activities and the growing use of instruments in manufacturing processes and research and development work. (See discussion, p. 450.) However, this occupation is relatively small and few openings will result in any one year.

Growing numbers of instrument makers will be needed to make models of new instruments that may be mass-produced in the future, and also to make custom or special purpose instruments that are not needed in large numbers. Many devices made by these craftsmen will be needed in the expanding field of industrial automation. Also, many new precision instruments, which will be even more versatile and sensitive than those in current use, can be expected to emerge from growing research and development programs of universities, Government agencies, private laboratories, and manufacturing firms.

Earnings and Working Conditions

Earnings of instrument makers compare favorably with those of other highly skilled metalworkers. In 1970, instrument makers generally earned between $3.50 and $5.30 an hour for a standard workweek.

Instrument shops usually are clean and well lighted. Room temperatures usually are controlled in shops where precision measuring instruments are used. Instrument assembly rooms are usually clean and are sometimes known as "White Rooms," where almost sterile conditions are maintained.

Serious work accidents are not common, but machine tools and flying particles sometimes cause finger, hand, and eye injuries. Safety rules generally require the wearing of special glasses, aprons, tightly fitted clothes, and shirts with elbow-length sleeves; the wearing of neckties is prohibited.

See introductory section of this chapter for a discussion of nonwage benefits received by machining workers, unions that organize these workers, and sources of additional information.

SETUP MEN (MACHINE TOOLS)

(D.O.T. 600.380; 604.280 and .380; 605.380; and 619.380)

Nature of the Work

The setup man, often called a machine tool job setter, is a skilled specialist employed in plant and machine shops that do machining in large volume. His main job is to set up machine tools—that is, to get machine tools ready for use by semiskilled operators. He also may explain to these workers the operations to be performed, and show them how to check the accuracy of their work. Usually a setup man is assigned a number of machine tools which often are of one type, such as turrent lathes. However, he may set up several different kinds, such as milling machines and automatic screw machines. Working from drawings, blueprints, written specifications, or job layouts, he determines the rate at which the material is to be fed into the machines, operating speeds, tooling, and operation sequence. He then selects and installs the proper cutting or other tools and adjusts guides, stops, and other controls. He may make trial runs and adjust the machine and tools until the parts produced conform to specifications. The machine is then turned over to a semiskilled operator. The setup man may make additional adjustments later to maintain standardized production.

Setup man prepares jig borer.

Places of Employment

Most setup men are employed in factories that manufacture fabricated metal products, transportation equipment, and machinery. These workers usually are employed by large companies that employ many semiskilled machine tool operators. They usually are not employed in maintenance shops or in small jobbing shops.

Training and Other Qualifications

To become a setup man, a worker usually must qualify as an all-round machinist or skilled machine tool operator. A setup man must be thoroughly trained in the operation of one or more kinds of machine tools. He must read blueprints and make computations in selecting speeds and feeds for machine tools. The ability to communicate clearly is important since he must explain to a semiskilled machine tool operator how to perform machining operations and how to check machining accuracy. Above all, a setup man must be skilled in selecting the sequence of operations so that metal parts will be made exactly to specifications. Openings for setup men usually are filled from within a shop by promotion or reassignment.

Employment Outlook

Employment of setup men is expected to increase moderately through the 1970's, as a result of the anticipated expansion of metalworking activities. Additional job opportunities will arise from the need to replace experienced setup men who retire, die, or transfer to other fields of work.

The use of numerically controlled machine tools may change the duties of setup men. In the future, setup men may only preset tools, instruct operators, and check the first few parts that are produced. Since setup men are skilled workers, their chances for advancement or transfer into other jobs, such as parts programmer, will remain good.

Earnings and Working Conditions

The earnings of setup men compare favorably with those of other skilled machining workers. In 1970, setup men generally earned between $3 and $5 an hour for a standard workweek.

Good safety habits are important since the setup man must handle sharp-cutting tools. He also may be exposed to high speed machine tools which have sharp-cutting instruments when he makes the trial runs to test the accuracy of the setup.

See the introductory section of this chapter for a discussion of non-wage benefits received by machining workers, unions that organize these workers, and sources of additional information.

MECHANICS AND REPAIRMEN

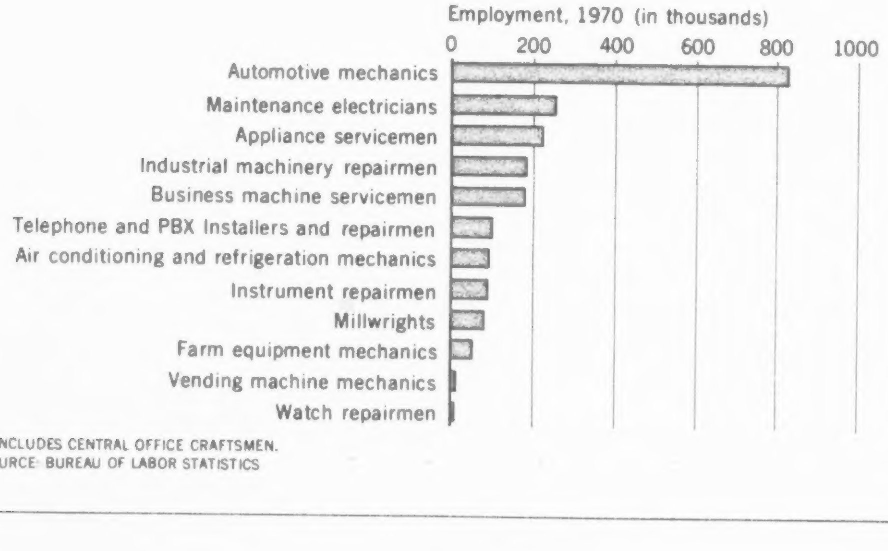
Mechanics and repairmen—the skilled workers who keep our automobiles, airplanes, industrial machinery, household appliances, and similar equipment operating properly—make up one of the fastest growing occupational groups in the Nation's labor force. This occupational field offers a variety of career opportunities to young men who are mechanically inclined and are willing to invest a few years in learning a trade.

Employment of mechanics and repairmen totaled nearly 2.8 million in 1970. More than one-third (840,000) of these were automotive mechanics, such as automobile mechanics, truck or bus mechanics, and automobile body repairmen. Other large occupations—each employing more that 100,000 workers—were appliance servicemen, business machine servicemen, industrial machinery repairmen, aircraft mechanics, and television and radio service technicians. (See Chart 27) Employment in some occupations, including vending machine mechanic, electric sign serviceman, bowling-pin-machine mechanic and X-ray equipment serviceman, was relatively small.

In addition to the nearly 2.8 million mechanics and repairmen employed in 1970, about 450,000 workers were employed in four mechanics and repairmen related occupations: maintenance electrician, telephone repairman, millwright, and watch repairman. Altogether, these 3.2 million maintenance and repair workers represented about 3 out of every 10 skilled workers.

Nearly 30 percent of the mechanics and repairmen were employed in manufacturing industries, and the majority of these were employed in plants that produce durable goods such as transportation equipment, machinery, primary metals, and fabricated metal products. About 20 percent of the mechanics and repairmen were employed in retail trade—mainly by firms that sell and service automobiles, household appliances, farm equipment, and other mechanical equipment. Another 20 percent were employed in shops that specialize in servicing such equipment. Most of the remaining mechanics and repairmen were employed in the transportation, construction, and public utilties industries, and by Government at all levels.

(27) Employment in selected maintenance and repair occupations



* INCLUDES CENTRAL OFFICE CRAFTSMEN.
SOURCE: BUREAU OF LABOR STATISTICS

Most employment opportunities for mechanics and repairmen occur in the more populous and industrialized States. About half of them work in eight states: California, New York, Pennsylvania, Texas, Illinois, Ohio, Michigan, and New Jersey.

Training, Other Qualifications, and Advancement

Many mechanics and repair men learn their skills on the job or through apprenticeship training. Some acquire their basic training in vocational and technical school, or attend such schools to increase their skills. Others qualify by taking correspondence courses. Training and experience in the armed services also may help young men prepare for occupations such as aircraft mechanic and television and radio serviceman.

Many employers consider a formal apprentice training program to be the best way to learn skilled maintenance and repair work. An apprenticeship consists of about 3 to 4 years of paid on-the-job training, supplemented each year by at least 144 hours of related classroom instruction. Formal apprenticeship agreements are registered with a State apprenticeship agency or the U.S. Department of Labor's Bureau of Apprenticeship and Training.

Employers look for applicants who have mechanical aptitude and manual dexterity. Many employers prefer people whose hobbies or interests include automobile repair, model building, or radio and television repair. A high school education often is required for employment. Employers also favor applicants who have had courses in mathematics, chemistry, physics, blueprint reading, and machine shop. Generally, apprentice applicants and other trainees are required to be at least 18 years old and in good health.

Physical requirements for work in this field vary greatly. For example, a millwright should be strong and agile, since he may need to climb ladders, lift heavy equipment, and work in awkward positions in cramped spaces. On the other hand, instrument and watch repairmen need patience, finger dexterity, and good vision. Persons with certain physical handicaps can repair watches.

Workers in most maintenance and repair occupations have several avenues of advancement. Some move into a supervisory position, such as foreman, maintenance manager, or service manager. Specialized training prepares others to advance to sales, technical writing, and technician jobs. Substantial numbers of servicemen have opened their own businesses.

Employment Outlook

Employment in maintenance and repair occupations as a whole is expected to increase moderately through the 1970's. Job openings resulting from employment growth, deaths, and retirements are expected to average more than 130,000 a year during this period. Additional job openings will result as experienced workers transfer to other occupations. Automobile mechanics, business machine servicemen, maintenance electricians, appliance servicemen, aircraft mechanics, industrial machinery repairmen, instrument repairmen, and television and radio service technicians will find many employment opportunities.

Many factors are expected to contribute to the growing demand for mechanics and repairmen. The anticipated rise in expenditures for new plant and equipment will result in more mechanization and the use of more complex machinery and equipment in many industries. Greater research and development expenditures probably will yield new and, in many cases, more complex products for use by industry and consumers. Growing numbers of household and higher levels of personal spendable income will contribute to an increased demand for household appliances, automobiles, lawnmowers, boats, and other items that mechanics and repairmen service.

In the future, applicants for maintenance and repair jobs will have to meet higher standards of performance to maintain and repair the increasingly complex equipment coming into general use. Young persons who acquire a good basic education (including courses in mathematics and science), as well as thorough job training, will be prepared better than other applicants to compete for the higher paying jobs that are likely to be available.

This chapter includes statements on the following maintenance and repair workers: Air-conditioning, refrigeration, and heating mechanics; appliance servicemen; bowling-pin-machine mechanics; automobile body repairmen; automobile mechanics; business machine servicemen; diesel mechanics; electric sign servicemen; farm equipment mechanics; industrial machinery repairmen; instrument repairmen; maintenance electricians; millwrights; motorcycle mechanics; television and radio service technicians; truck and bus mechanics; vending machine mechanics; and watch repairmen. Other maintenance and repair workers are discussed in other chapters in the *Handbook*. For example, aircraft mechanics are discussed in Civil Aviation Occupations and telephone and PBX installers and repairmen in Occupations in the Telephone Industry.

AIR-CONDITIONING, REFRIGERATION, AND HEATING MECHANICS

(D.O.T. 637.281 and .381; 862.281 and .381; and 869.281)

Nature of the Work

Air-conditioning, refrigeration, and heating mechanics work on cooling and heating equipment used in homes, offices, schools, and other buildings. Major occupations in this fields are air-conditioning and refrigeration mechanic, furnace installer, oil burner mechanic, and gas burner mechanic. Many workers are skilled in more than one of these trades. This statement does not cover mechanics who work on railroad, truck, automotive, or marine air-conditioning and refrigeration equipment.

Air-conditioning and refrigeration mechanics (D.O.T. 637.281 and .381) install and repair equipment ranging in size from small window air-conditioners to large central-plant type air-conditioning or refrigeration systems. When installing new equipment, the mechanic puts the motors, compressors or absorption equipment, evaporators, and other components in place, following blueprints and design specifications. He connects duct work, refrigerant lines, and other piping and then connects the equipment to an electrical power source. After completing the installation, he charges the system with refrigerant and checks it for proper operation.

When air-conditioning and refrigeration equipment breaks down, the mechanic diagnoses the cause and makes the necessary repairs. When looking for defects, he may inspect components such as relays and thermostats. Tools and equipment used include electric drills, pipe cutters and benders, acetylene torches, and testing devices such as refrigerant gages and ammeters.

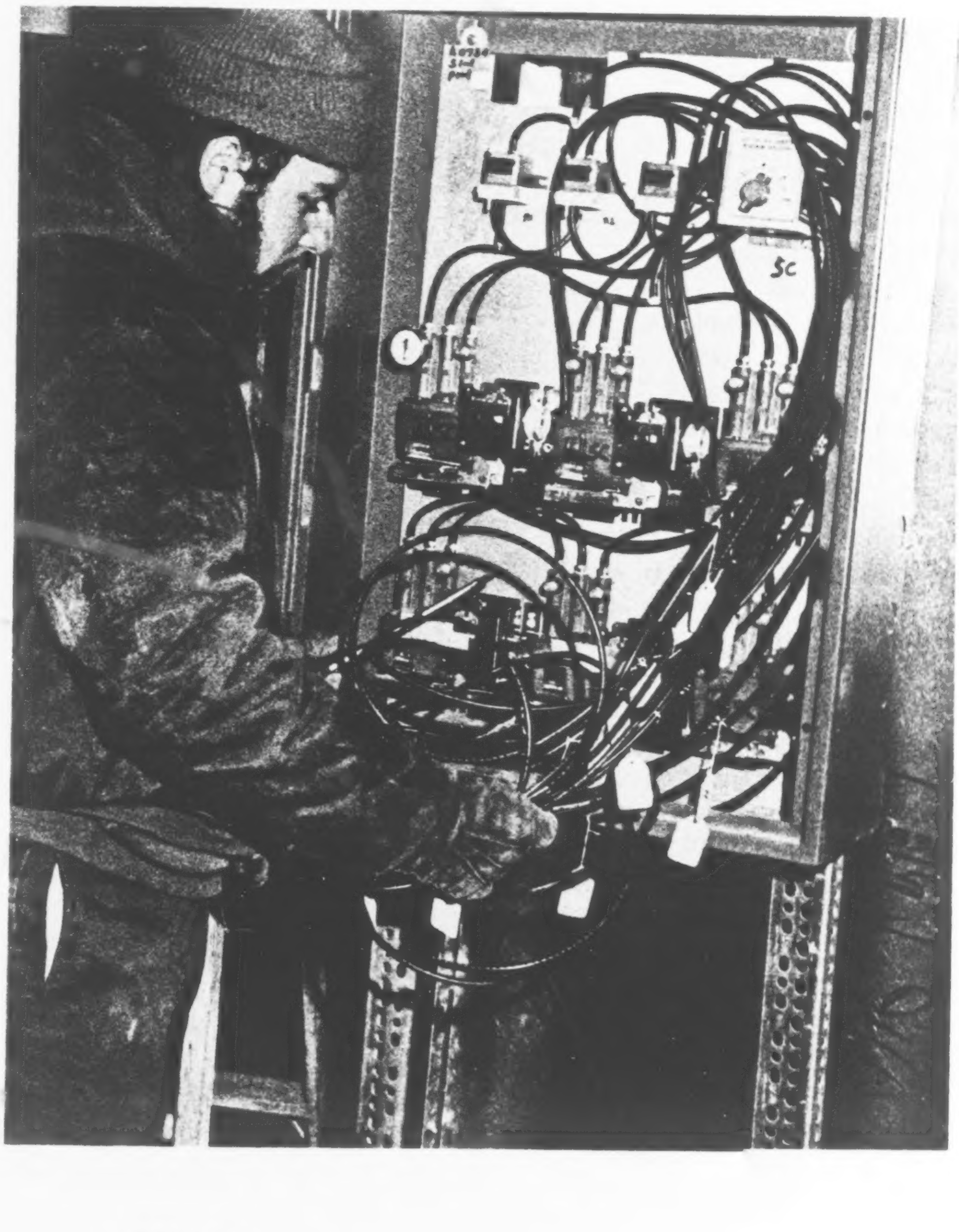
Furnace installers (D.O.T. 862.381 and 869.281), also called heating equipment installers, follow blueprints or other specifications to install oil, gas, and electric heating units. After setting the heating unit in place, they install fuel pipes, air ducts, pumps, and other components. They then connect electrical wiring and controls, and check the unit for proper operation.

Oil burner mechanics (D.O.T. 862.281) keep oil-fueled heating systems in good operating condition. During the fall and winter, they service and adjust oil burners and oil-fueled heating systems. The mechanic determines the reason a burner is not operating properly by checking the thermostat, burner nozzles, controls, and other parts. The mechanic may carry a large stock of replacement parts in his truck to make repairs in the customer's home or business. However, if major repairs are necessary, he usually completes the work in the repair shop. During the summer the mechanic services heating units, replaces oil and air filters, and vacuum cleans vents, ducts, and other parts of the heating system that accumulate soot and ash.

Gas burner mechanics (D.O.T. 637.281), also called gas appliance servicemen, have duties similar to those of oil burner mechanics. They diagnose malfunctions in gas-fueled heating systems and make necessary repairs and adjustments. They also may repair cooking stoves, clothes dryers, and hot water heaters. During the summer mechanics employed by gas utility companies may inspect and repair gas meters.

Furnace installers, oil burner mechanics, and gas burner mechanics use a variety of tools, including hammers, wrenches, metal snips, electric drills, pipe cutters and benders, and acetylene torches. They also use testing devices such as vacuum gages, volt meters, air velocity meters, and electronic circuit testers.

Cooling and heating systems sometimes are installed or repaired by craftsmen other than the mechanics discussed here. For example, on a large air-conditioning installation job, especially where workers are covered by union-management contracts, duct work might be done by



sheet-metal workers; electrical work by electricians; and installation of piping, condensers, and other components by pipefitters. Appliance servicemen often install and repair window air conditioners. Additional information about appliance servicemen appears elsewhere in the *Handbook*.

Places of Employment

An estimated 115,000 air-conditioning, refrigeration, and heating mechanics were employed in 1970. These mechanics worked mainly for dealers and contractors who specialize in selling and servicing cooling and heating equipment; construction companies; fuel oil dealers; and gas utility companies. Air-conditioning and refrigeration mechanics, as well as furnace installers, were employed primarily by cooling and heating dealers and contractors. Fuel oil dealers employ most oil burner mechanics, and gas utility companies employ most gas burner mechanics.

Air-conditioning and refrigeration mechanics, and furnace installers are employed in all parts of the country. Generally, the geographic distribution of these workers is similar to that of our population. The employment of oil burner mechanics is concentrated in States where oil is a major heating fuel. More than half of these workers are employed in New York, Masachusetts, Pennsylvania, New Jersey, Connecticut, and Illinois. Similarly, the employment of gas burner mechanics is concentrated in States where gas is a major heating fuel. More than half of these workers are employed in California, Texas, Ohio, Illinois, Michigan, Pennsylvania, and New York.

Training, Other Qualifications, and Advancement

Most air-conditioning, refrigeration, and heating mechanics start as helpers and acquire their skills by working for several years with experienced mechanics. Beginners perform simple tasks, such as insulating refrigerant lines or cleaning furnaces. As helpers gain experience, they are given progressively more complicated tasks such as installing pumps and burners and checking circuits.

A growing number of employers prefer high school graduates who have had courses in mathematics, physics, and blueprint reading. Mechanical aptitude and an interest in electricity also are important qualifications. A good physical condition helps in lifting and moving heavy equipment.

Many high school and vocational schools cooperate with local employers and organizations such as the Air-Conditioning and Refrigeration Institute and the National Oil Fuel Institute in offering basic mechanics courses. These courses may last from 2 to 3 years and consist of on-the-job training and classroom instruction. In 1970, unemployed and underemployed workers were trained in programs lasting up to a year in many cities under the Manpower Development and Training Act. Additional on-the-job training and experience is needed to qualify these students as skilled mechanics.

Apprenticeship programs for pipefitters, electricians, and sheet-metal workers often include training in air-conditioning, refrigeration, and heating. Journeymen in these trades may specialize in installing and maintaining air-conditioning, refrigeration, and heating equipment. Additional information about these trades appears elsewhere in the *Handbook*.

Employment Outlook

Employment of air-conditioning, refrigeration, and heating mechanics is expected to increase very rapidly through the 1970's. In addition to the anticipated employment growth, a few thousand job openings will arise annually to replace experienced mechanics who retire or die. Openings also will occur as experienced mechanics transfer to other occupations.

Most new openings will be for air-conditioning and refrigeration mechanics. Anticipated increases in household formations and rising personal incomes indicate a very rapid increase in the number of air-conditioned homes. Air-conditioning in offices, stores, hospitals, schools, and other nonresidential buildings also is expected to increase. In addition, more refrigeration equipment will be needed in the production, storage, and marketing of food and other perishables.

Employment of furnace installers and gas burner mechanics is expected to follow the rapid growth trends in the construction of homes and businesses. However, these workers may experience some competition for jobs as a result of the small but rapidly growing number of electrically heated homes and businesses. Electric heating systems usually are installed and serviced by electricians.

Employment of oil burner mechanics is expected to remain fairly stable during the 1970's, since relatively few new homes are being built with oil heating systems. Nevertheless, employment opportunities for oil heating mechanics will occur as experienced mechanics retire, die, or transfer to other occupations.

Earnings and Working Conditions

Earnings data for air conditioning, refrigeration, and heating mechanics are not available on a national basis. In 1970, however, several employers indicated that straight-time hourly rates for skilled mechanics ranged from about $3.25 to $7. Skilled mechanics generally earned between two and three times as much as inexperienced helpers. Rates of pay for helpers and mechanics depended on factors such as level of skill, type of equipment worked on, and geographic area. For example, mechanics who worked on both air-conditioning and heating equipment frequently had higher rates of pay than those who worked on only one type of equipment.

Wage rates may range considerably higher for electricians, pipefitters, and sheet-metal workers who are employed by construction firms specializing in air-conditioning, refrigeration, and heating work. Union minimum hourly rates for journeymen construction electricians, pipefitters, and sheet-metal workers averaged $6.82, $6.93, and $6.75, respectively, on July 1, 1970. (See individual statements on these trades for additional wage information.)

Most mechanics work a 40-hour week. However, during seasonal peaks they often work overtime or irregular hours. Air-conditioning and refrigeration mechanics are busiest during spring and summer. Oil burner mechanics and gas burner mechanics are busiest during fall and winter. Most employers try to provide their mechanics with a full workweek the year round, but they may temporarily reduce their hours of work or lay off some of them when seasonal peaks end. However, employment in most shops that install and service both air-conditioning and heating equipment is fairly stable throughout the year.

Mechanics sometimes are required to work at great heights when installing new equipment. They also may work in awkward or cramped positions to reach motors or other parts of the equipment they are repairing. Common hazards in this trade include electrical shock, torch burns, muscle strains, and other injuries that may result from handling heavy equipment.

Sources of Additional Information

Information about employment opportunities for air-conditioning, refrigeration, and heating mechanics can be obtained from the local office of the State employment service, as well as firms that employ these workers. The State employment service also may be a source of information about training opportunities available under the Manpower Development and Training Act, apprenticeship, and other training programs.

Information about advanced training in air-conditioning and refrigeration may be obtained from the Refrigeration Service Engineers Society, 433 North Waller Ave., Chicago, Ill. 60644.

Information about oil heating systems training may be obtained from the Education Department, National Oil Fuel Institute, 60 East 42nd St., New York, N.Y. 10017, or its local or State organization.

General information about gas burner mechanics may be obtained from the American Gas Association, Inc., 605 Third Ave., New York, N.Y. 10016.

APPLIANCE SERVICEMEN

(D.O.T. 637.281, 723.381, and 827.281)

Nature of the Work

Appliance servicemen repair appliances that range from small, relatively uncomplicated items such as toasters and irons, to large appliances that may have complex control systems, such as refrigerators and automatic washing machines. To repair appliances, the serviceman first determines why they are not operating properly and then installs new parts, repairs parts, or makes adjustments. Appliance servicemen usually specialize in the repair of either electric or gas appliances, and in the case of large appliances, specialize in the repair of a single type, such as clothes washers and dryers, refrigerators, freezers, or dishwashers.

To determine why an appliance is not operating properly, servicemen may ask customers how the appliance performed when it was used previously. They may operate an appliance to detect unusual noises; overheating; excess vibration; and broken, worn, or loose parts. Servicemen also look for common sources of trouble such as faulty gas, electric, and fluid lines and connections. To check electric and gas systems, they use special tools and testing devices, including ammeters, ohmmeters, voltmeters, and manometers, combustion test equipment, and vacuum and pressure gages.

After servicemen determine why

an appliance is not operating properly, they make the necessary repairs and adjustments. This work frequently involves replacing parts that receive extra wear, such as electric cords on small appliances, or cleaning parts such as the lint filters in clothes dryers. To remove old parts and install new ones, servicemen use common handtools, including screwdrivers and pliers, and may use special wrenches and other handtools designed for use on particular appliances.

Most refrigerators and other large appliances are repaired in the customers' homes. However, if major repairs are necessary, the appliance is removed to a repair shop. Small appliances usually are brought to a repair shop by the customer.

An important part of the work of most appliance servicemen is personal contact with customers. They answer customers' questions and complaints about appliances and frequently advise customers about their care and use. For example, they may demonstrate to housewives the proper loading of automatic washing machines or how to arrange dishes in dishwashers.

Appliance servicemen have variety in their work. They may drive light trucks or automobiles, some equipped with two-way radios. They may give estimates to customers on the cost of repair jobs, and usually keep records of parts used and hours worked on each repair job.

Places of Employment

An estimated 220,000 appliance servicemen were employed throughout the country in 1970, mostly in independent repair shops and service centers of retail establishments such as department and appliance stores. Other were employed in service centers operated by appliance manufacturers and wholesale distributors of appliances and by gas and electric utility companies.

Appliance servicemen are employed in almost every community. Most servicemen, however, are employed in the more highly populated States and metropolitan areas.

Training, Other Qualifications, and Advancement

Appliance servicemen usually are hired as helpers and acquire their skills through on-the-job training and work experience. Inexperienced men are given relatively simple work assignments. In some companies, they work for the first few months helping to install appliances in homes, driving service trucks, and learning street locations. In other companies, they begin to learn the skills of appliance servicemen by working in the shop where they rebuild used parts such as washing machine transmissions. Trainees gradually learn how motors, gears, and other appliance parts operate. They progress from simple repair jobs, such as replacing a switch, to more difficult jobs such as adjusting automatic washing machine controls. In addition to practical experience on the job, trainees frequently receive classroom instruction given by appliance manufacturers and local distributors. Many trainees take correspondence courses in basic electricity and electronics or attend technical schools to increase their skills in appliance repair.

Trainees usually are supervised closely for 6 to 12 months. By this time, most gas-appliance servicemen can repair several kinds of appliances on their own, and they may be given responsibility for their own service trucks and for appliance parts and tools. Electrical-appliance servicemen usually need up to 3 years' on-the-job experience to become fully qualified. Many experienced servicemen attend training classes (often on company time) and study service manuals to become familiar with new appliances and the best ways to repair them.

Appliance servicemen must understand, in a practical way, how to use equipment that measures electricity and how to use measurements to determine whether electrical currents in appliances are flowing properly. A knowledge of wiring diagrams that show electrical connections and current flow between appliance parts also is important. A knowledge of electronics is necessary to perform some appliance repair jobs.

Programs to train unemployed and underemployed workers for entry jobs in the appliance service field were operating in many cities in 1970 under the Manpower Development and Training Act. These programs lasted from several weeks to a year; most lasted longer than 5 months. Through additional training and experience, graduates of these programs can eventually become skilled servicemen.

Employers prefer applicants having good mechanical aptitude, particularly high school and trade school graduates who have had courses in electricity, mathematics, and science. Some employers, in cooperation with local high schools and trade schools, provide students with an opportunity to gain practical experience by working part-time in appliance repair shops while attending school. Additional on-the-job training and work experience after graduation can qualify these students as skilled appliance servicemen.

Appliance servicemen who work in large repair shops or service centers and show technical proficiency may be promoted to foreman, assistant service manager, or service manager. Preference is given to men who also have shown ability to cooperate with other servicemen and with customers. A general knowledge of bookkeeping and other subjects related to managing a business is helpful. Experienced servicemen who have sufficient funds may open their own appliance sales or repair shops.

Servicemen who work for appliance manufacturers may become instructors, who teach servicemen to repair new models of appliances, or technical writers, who prepare service manuals. A few servicemen may advance to managerial positions such as regional service or parts manager.

Employment Outlook

Employment of appliance servicemen is expected to grow rapidly through the 1970's. In addition to opportunities resulting from growth, thousands of opportunities will arise annually to replace experienced servicemen who retire, die, or transfer to other kinds of work.

The number of household appliances in use is expected to increase rapidly during the 1970's. Factors that will contribute to the demand for appliances include increasing population and family formations; rising levels of personal income; introduction of new appliances; and improved styling to make existing models more attractive and easier to operate. In addition, more widespread use of appliances such as electric can openers, waste disposers, home clothes dryers, dishwashers, and knife sharpeners is expected.

Employment of appliance servicemen is not expected to increase as rapidly as the number of appliances in use. Although the automatic operation of some types of appliances has tended to make them more complicated, manufacturers are designing appliances with more durable components, and appliances that can be taken apart and repaired more easily. In addition, employers are increasing the efficiency of servicemen through more effective training.

Earnings and Working Conditions

National earnings data are not available for appliance servicemen. However, wage data obtained from a large number of employers and union-management contracts in 1970 indicated that most experienced servicemen earned more than $3 and some earned as much as $5.30. Inexperienced helpers generally start at $2 to $3 an hour. The wide variations in wage rates for servicemen and their helpers reflect differences in type of employer, geographical location of the job, the type of equipment serviced, and skill levels. Many appliance servicemen work more than 8 hours a day and receive higher rates of pay for overtime. Most appliance servicemen receive paid vacations, sick leave, health insurance, and other employee benefits, as well as credit toward retirement pensions.

Appliance repair shops are relatively quiet, well lighted, and adequately ventilated. When repairing small appliances, servicemen usually sit at benches. Working conditions outside the shop vary considerably. Servicemen sometimes work in narrow spaces, uncomfortable positions, and places that are not clean. Servicemen who repair large appliances may spend several hours a day driving between customers' homes.

Appliance repair work generally is safe, although accidents are possible while the serviceman is driving, handling electrical parts, or lifting or moving large appliances. Inexperienced men are shown how to use tools safely and instructed in simple precautions against electric shock.

The work of appliance servicemen often is performed with little direct supervision. This feature of the job appeals to many people.

Sources of Additional Information

Further information about jobs in the appliance service field may be obtained from local appliance repair shops, appliance dealers, gas and electric utility companies, appliance manufacturers, and local offices of the State employment service. Local vocational schools that offer courses in appliance servicing, electricity, and electronics can provide helpful information about training. The State employment service also may provide information about the Manpower Development and Training Act and other programs that provide training opportunities.

Information about training programs or work opportunities in this field also may be obtained from:

Association of Home Appliance Manufacturers, 20 North Wacker Drive, Chicago, Ill. 60606.

National Appliance and Radio–TV Dealers Association, 318 W Randolph St., Chicago, Ill. 60601.

Gas Appliance Manufacturers Association, 1901 North Fort Myer Drive, Arlington, Va. 22209.

AUTOMOBILE BODY REPAIRMEN

(D.O.T. 807.381)

Nature of the Work

Automobile body repairmen are skilled craftsmen who repair damaged motor vehicles by straightening bent frames, removing dents from fenders and body panels, welding torn metal, and replacing badly damaged parts. Body repairmen usually are qualified to repair all types of vehicles, although most work mainly on automobiles and small trucks. Some specialize in repairing large trucks, buses, or truck trailers.

Before making repairs, body repairmen generally receive instructions from their supervisors, who determine which parts are to be restored or replaced, and who estimate the amount of time the repairs should take. When repairing damaged fenders and other body parts, the body repairman may first remove body hardware, window operating equipment, and trim in order to gain access to the damaged area. To reshape the metal, he may push large dents out with a hydraulic jack or hand prying bar, or knock them out with a hand tool or pneumatic hammer. He smoothes remaining small dents and creases by holding a small anvil against one side of the damaged area while hammering the opposite side. Very small pits and dimples are removed from the metal by pick hammers and punches.

The body repairman may remove badly damaged sections of body panels with a pneumatic metalcutting gun or acetylene torch, and weld in new sections. If the damage tears the metal, he welds the torn edges. He shrinks stretched metal by repeatedly heating the area with an acetylene torch and striking it with a hammer to restore the metal's original shape.

The automobile body repairman uses solder or plastic to fill small dents that he cannot work out of the metal. Before applying solder, he cleans the dent and coats it with liquid tin so that the solder will adhere to the surface. He softens the solder with a torch and uses a wooden paddle or other tool to mold it to the desired shape. When the solder has hardened, the body repairman files or grinds it down to the level of the adjacent metal.

After being restored to its original shape, the repaired surface is sanded in preparation for painting. In most shops, automobile painters do the painting. (These workers are discussed elsewhere in the *Handbook.*) Some smaller shops employ workers who are combination body repairmen and painters.

The automobile body repairman uses special machines to align damaged vehicle frames and body sections. He chains or clamps the machine to the damaged metal and applies hydraulic pressure to straighten it. He also may use special devices to align damaged vehicles that have "unit-bodies" instead of frames. In some shops, the straightening of frames and unit-bodies is done by a body repairman who specializes in this type of work.

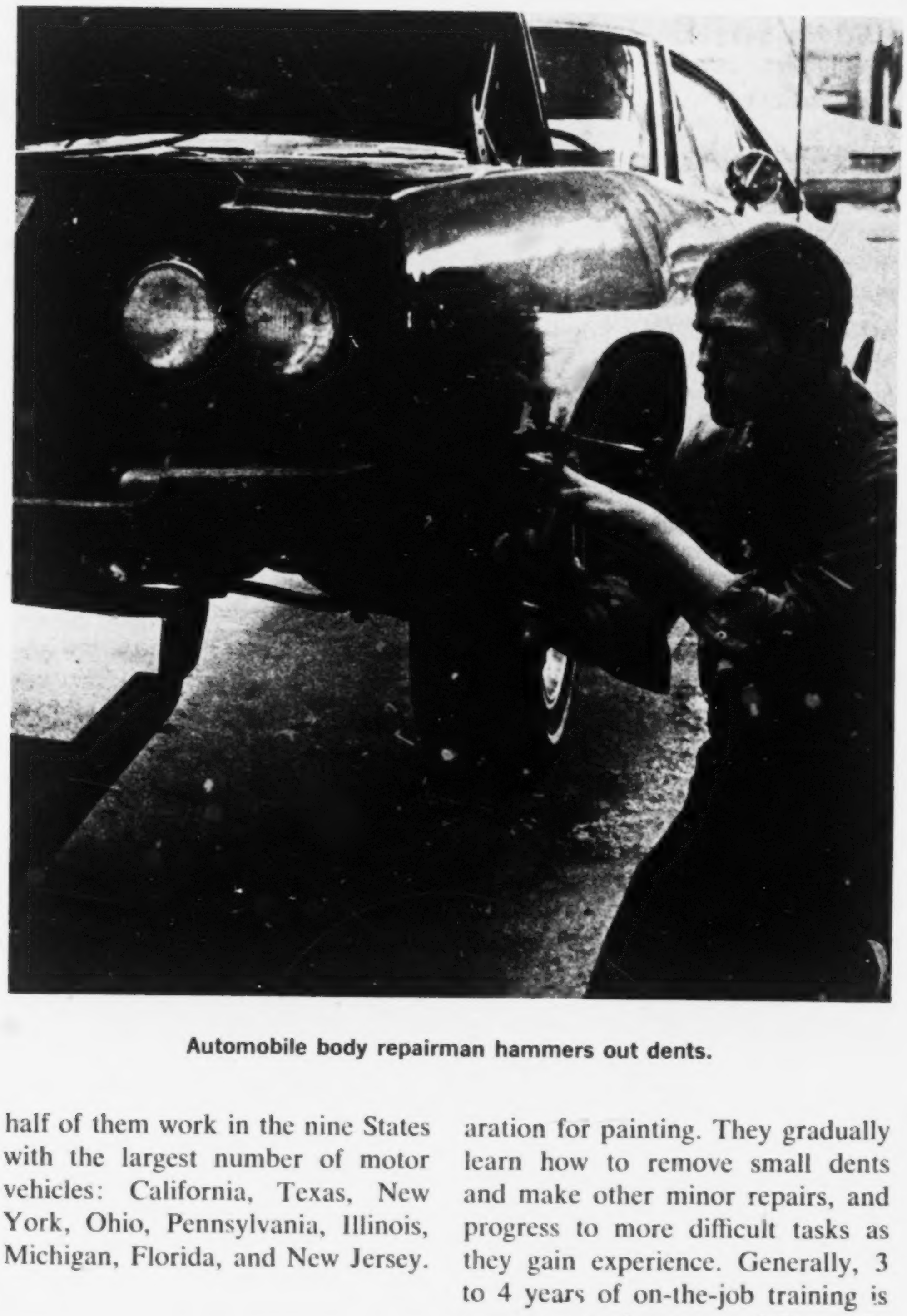
The body repairman's work is characterized by variety because the repair of each damaged vehicle presents a different problem. Therefore, in addition to having a broad knowledge of automobile construction and repair techniques, he also must develop appropriate methods for each repair job. Most body repairmen find their work challenging and take pride in being able to restore damaged automobiles.

Automobile body repairmen usually work by themselves with only general directions from foremen. In some shops, they may be assisted by helpers.

Places of Employment

More than 100,000 automobile body repairmen were employed in 1970. Most of them worked in shops that specialized in automobile body repairs and painting, and in the service departments of automobile and truck dealers. Other employers included organizations that maintain their own fleets of motor vehicles, such as trucking companies and buslines, and Federal, State, and local governments. Motor vehicle manufacturers employed a small number of these workers.

Automobile body repairmen can find employment opportunities in every section of the country. About



Automobile body repairman hammers out dents.

half of them work in the nine States with the largest number of motor vehicles: California, Texas, New York, Ohio, Pennsylvania, Illinois, Michigan, Florida, and New Jersey.

Training, Other Qualifications, and Advancement

Most automobile body repairmen learn the trade on-the-job. Young persons usually start as helpers and pick up the skills of the trade from experienced workers. Helpers begin by assisting body repairmen in tasks such as removing damaged parts, installing repaired surfaces in preparation for painting. They gradually learn how to remove small dents and make other minor repairs, and progress to more difficult tasks as they gain experience. Generally, 3 to 4 years of on-the-job training is necessary to become a fully qualified body repairman.

Although most workers who become automobile body repairmen pick up the skills of the trade informally through on-the-job experience, most training authorities recommend the completion of a 3- or 4-year formal apprenticeship program as the best way for young men to learn this trade. These programs include both on-the-job and related classroom instruction.

Training programs for unemployed and underemployed workers for entry automobile body repairmen jobs are in operation in many cities under provisions of the Manpower Development and Training Act. These programs, which last up to a year, stress the fundamentals of automobile body repair. Persons who complete these programs need additional on-the-job or apprenticeship training before they can qualify as skilled body repairmen.

Young persons interested in becoming automobile body repairmen should be in good physical condition and have good eye-hand coordination. Courses in automobile body repair, offered by a relatively small number of high schools, vocational schools, and private trade schools, provide helpful experience, as do courses in automobile mechanics. Although completion of high school is not generally a requirement for an entry job, many employers believe graduation indicates that a young man can "finish a job."

Automobile body repairmen usually are required to own their handtools, but power tools ordinarily are furnished by the employer. Many of these craftsmen have a few hundred dollars invested in tools. Trainees are expected to accumulate tools as they gain experience.

An experienced automobile body repairman with supervisory ability may advance to shop foreman. Many body repairmen open their own shops.

Employment Outlook

Employment of automobile body repairmen is expected to increase moderately through the 1970's. In addition to the job openings resulting from employment growth, more than a thousand openings are expected each year from the need to replace experienced body repairmen who retire or die. Job openings also will occur as some body repairmen transfer to other occupations.

The number of body repairmen is expected to increase primarily as a result of the rising number of motor vehicles damaged in traffic. Accidents are expected to continue to increase as the number of motor vehicles in use grows, even though new and improved highways, driver training courses, added safety features on new vehicles, and stricter law enforcement may slow down the rate of increase.

The favorable employment effect of the rising number of motor vehicle accidents will be offset somewhat by developments that will increase the efficiency of body repairmen. For example, the growing practice of replacing rather than repairing damaged parts, the use of plastics for filling dents, and improved tools will enable these workers to complete jobs in less time.

Earnings and Working Conditions

Body repairmen employed by automobile dealers in 34 cities had average straight-time earnings of $5.51, based on a survey in late 1969. Average hourly earnings of these workers in individual cities ranged from $3.83 in Providence–Pawtucket, R.I., to $7.67 in Detroit, Mich. Skilled body repairmen usually earn between two and three times as much as inexperienced helpers and trainees.

Many experienced body repairmen employed by automobile dealers and independent repair shops are paid a commission, usually about 50 percent of the labor cost charged to the customer. Under this method, a worker's earnings depend mainly on the amount of work he is assigned and how fast he completes it. Employers frequently guarantee their commissioned body repairmen a minimum weekly salary. Helpers and trainees are usually paid an hourly rate until they are sufficiently skilled to work on commission. Body repairmen employed by trucking companies, buslines, and other organizations that maintain their own vehicles usually receive an hourly wage rate. Most body repairmen work 40 to 48 hours a week.

Many employers of body repairmen provide holiday and vacation pay, and additional benefits such as life, health, and accident insurance. Some also contribute to retirement plans. Body repairmen in some shops are furnished with laundered uniforms free of charge.

Automobile body shops are noisy because of the banging of hammers against metal and the whir of power tools. Most shops are well ventilated, but often they are dusty and the odor of paint is noticeable. Body repairmen often work in awkward or cramped positions, and much of their work is strenuous and dirty. Hazards include cuts from sharp metal edges, burns from torches and heated metal, and injuries from power tools.

Many automobile body repairmen are members of unions, including the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Most body repairmen who are union members are employed by large automobile dealers and by trucking companies and buslines.

Sources of Additional Information

For further information regarding work opportunities for automobile body repairmen, inquiries should be directed to local employers, such as automobile body repair shops and automobile dealers; locals of the unions previously mentioned; or the local office of the State employment service. The State employment service also may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of automobile body repairmen may be obtained from:

Automotive Service Industry Association, 230 North Michigan Ave., Chicago, Ill. 60601.

Independent Garage Owners of America, Inc., 624 South Michigan Ave., Chicago, Ill. 60605.

AUTOMOBILE MECHANICS

(D.O.T. 620.131 through .381, .782, and .885; 721.281 and 825.281)

Nature of the Work

Automobile mechanics keep the Nation's automobiles in good operating condition. They perform preventive maintenance, diagnose breakdowns, and make repairs. (Although truck mechanics, who repair large trucks; bus mechanics, who repair large buses; and automobile body repairmen are sometimes called "automobile mechanics," they are discussed separately in the *Handbook*.)

Preventive maintenance is the periodic examination, and adjustment, repair, or replacement of parts. It is an important responsibility of the mechanic and is vital to safe and trouble-free driving. When performing preventive maintenance, the mechanic may follow a checklist to be sure he examines all important parts of the car. He may, for example, examine and decide whether to replace worn parts, such as distributor points; clean, adjust, or replace spark plugs; adjust the carburetor; and balance the wheels.

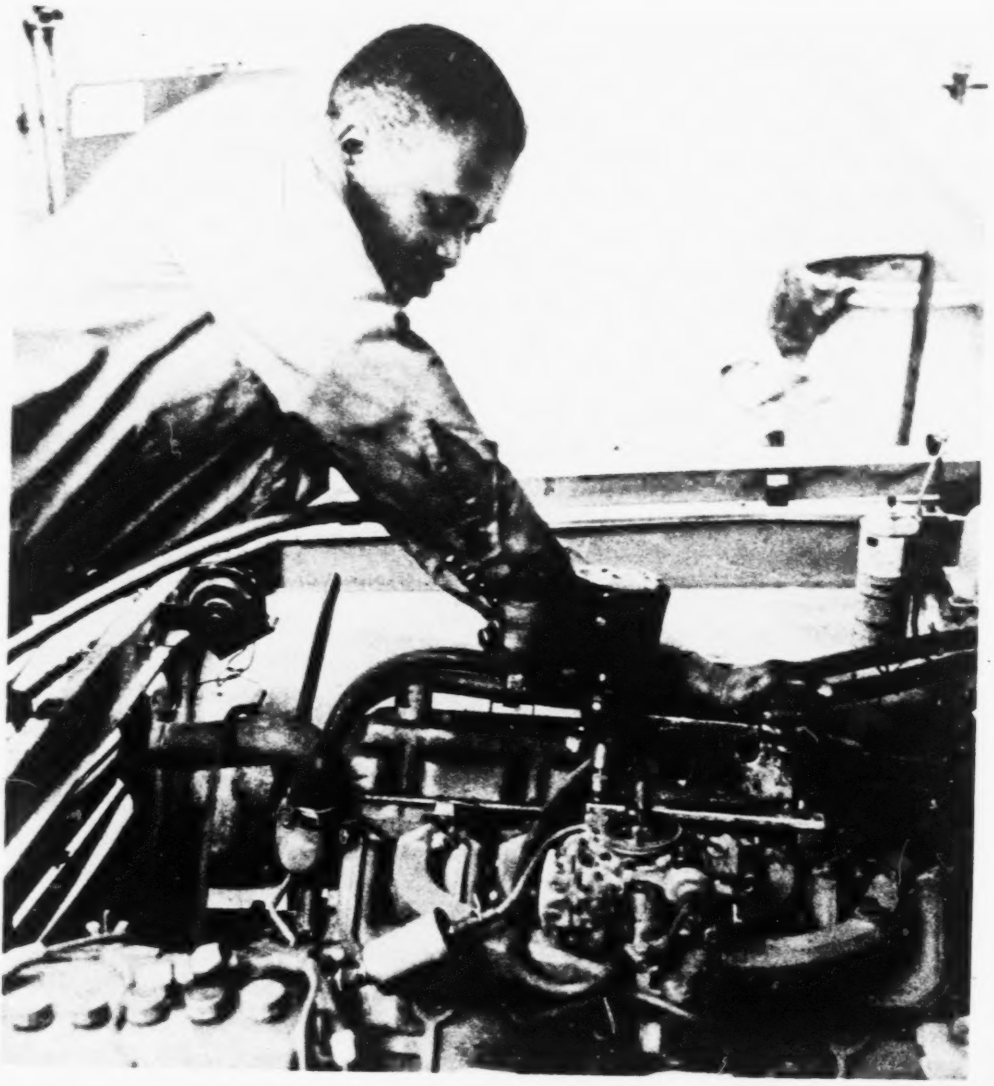
When mechanical or electrical troubles occur, the mechanic first obtains a description of the symptoms from the owner. If the cause of the trouble is not evident immediately, he may visually inspect and listen to the motor, or drive the car. He also may use a variety of testing equipment, such as motor analyzers, spark plug testers, compression gauges, and electrical test meters. The ability to make an accurate diagnosis in a minimum of time is one of the mechanic's most valuable skills and requires analytical ability as well as a thorough knowledge of a car's operations. Many skilled mechanics consider diagnosing "hard to find" troubles one of their most challenging and satisfying duties.

When the mechanic locates the cause of the trouble, he adjusts, repairs, or replaces unserviceable parts. For example, he may replace a fuel pump, grind valves, adjust the ignition timing, clean the carburetor, or machine the brake drums.

In addition to the testing equipment mentioned previously, automobile mechanics use many other kinds of tools and equipment. These may range from simple handtools (screwdrivers, wrenches, pliers), to complicated and expensive machines and equipment that help the mechanic make repairs. Examples of this equipment are wheel alinement machines and headlight aimers. Mechanics also consult repair manuals and parts catalogs, since different makes of automobiles require different parts and adjustments.

Most automobile mechanics perform a variety of repairs. Some mechanics, such as automatic transmission specialists, tune-up men, automobile air-conditioning specialists, front-end mechanics, and brake mechanics specialize in one or two types of repair. However, specialists with all-round skills also may perform general automobile repair work. Other specialists, such as automobile radiator mechanics and automobile glass mechanics, who do not have all-round skills, usually work exclusively at their specialties. The types of work done by some mechanic specialists are described briefly below:

Automatic transmission specialists repair and replace linkage, gear trains, couplings, hydraulic pumps, and other parts of automatic transmissions. Automatic transmissions are complex mechanisms; their repair requires considerable experience and training, including a knowledge of hydraulics. *Tune-up men* adjust the ignition timing and valves, and adjust or replace spark plugs, distributor breaker points, and other parts to insure efficient



engine performance. They often use scientific test equipment to locate malfunctions in fuel and ignition systems. *Automobile air-conditioning specialists* install air-conditioners and repair and adjust components such as compressors and condensers. *Front-end mechanics* align and balance wheels and repair steering mechanisms and suspension systems. They frequently use special alignment testing equipment and wheel-balancing machines. *Brake mechanics* adjust brakes, replace brake linings, resurface brake drums, repair hydraulic cylinders, and make other repairs on brake systems. Those employed in repair shops that specialize in brake service also may replace shock absorbers, springs, and mufflers. In some shops, combination front-end and brake mechanics are employed. *Automobile-radiator mechanics* clean radiators with caustic solutions, locate and solder radiator leaks, and install new radiator cores. They also may repair heaters and air-conditioners, and solder leaks in gasoline tanks. *Automobile-glass mechanics* replace broken or pitted windshield and window glass and repair manual and power-window mechanisms. They install pre-formed glass to replace curved windows, and may cut some replacement glass from flat sheets by using window patterns and glass cutting tools. Shops that repair both automobile radiators and glass may employ mechanics who are skilled in both specialties.

Places of Employment

Most of the more than 600,000 automobile mechanics employed in 1970 worked for automobile dealers, independent automobile repair shops, and gasoline service stations. Many others were employed by Federal, State, and local governments, taxicab and automobile leasing companies, and other organizations that maintain and repair their own automobiles. Some mechanics also were employed by automobile manufacturers to make final adjustments and repairs at the end of the assembly line. A small number of mechanics were employed by department stores that have automobile service facilities.

Most automobile mechanics work in shops employing from one to five mechanics, but some of the largest repair shops employ more than a hundred. Generally, automobile dealer shops are larger than independent repair shops.

Automobile mechanics are employed in every section of the country. About half of them work in the nine States with the largest number of motor vehicles: California, Texas, New York, Ohio, Pennsylvania, Illinois, Michigan, Florida, and New Jersey.

Training, Other Qualifications, and Advancement

Most automobile mechanics learn the trade through on-the-job experience. Young persons usually start as helpers, lubrication men, or gasoline service station attendants, and gradually acquire the necessary knowledge and skills by working with experienced mechanics. Although a beginner can learn to do simple kinds of repair work after a few months' experience, 3 to 4 years are required to become an all-round mechanic, and an additional year or two to learn a difficult specialty, such as automatic transmission repair. In contrast, radiator mechanics, glass mechanics, and brake specialists, who do not need an all-round knowledge of automobile repair, may learn their specialties in about 2 years.

Most training authorities recommend the completion of a 3- or 4-year formal apprenticeship program as the best way to become an all-round mechanic. These programs include both on-the-job training and related classroom instruction in nearly all phases of automobile repair.

For entry jobs, employers look for young persons with mechanical aptitude and an understanding of automobile construction and operation. Generally, a driver's license is required. Practical experience in automobile repair gained from working as a gasoline service station attendant, training in the Armed Forces, or working on cars as a hobby may be helpful. Courses in automobile repair offered by many high schools, vocational schools, and private trade schools also are valuable. Courses in science and mathematics help a person better understand how an automobile operates.

Training programs for unemployed and underemployed workers seeking entry jobs as automobile mechanics are in operation in a large number of cities under provisions of the Manpower Development and Training Act. These programs, which last up to a year, stress basic maintenance and repair work. Persons who complete this training are able to make simple repairs, but they still need additional on-the-job or apprenticeship training before they can qualify as skilled mechanics.

Completion of high school is an advantage in obtaining an entry mechanic job because to most employers high school graduation indicates that a young person can "finish a job," and has potential for advancement.

Most mechanics are required to purchase their own handtools. Beginners are expected to accumulate tools while they gain experience. Many experienced mechanics have several hundred dollars invested in their tools. Employers furnish engine analyzers and other test equipment, power tools, and special tools for servicing units such as automatic transmissions.

Employers sometimes send experienced mechanics to factory training centers to learn how to repair new car models or receive special training in subjects such as automatic transmission or air-conditioning repair. Manufacturers also send representatives to local shops to conduct short training sessions. A relatively small number of young high school graduates are selected by automobile dealers to attend factory-sponsored mechanic training programs for beginners.

A young person considering a career as an automobile mechanic should have strength and manual dexterity in order to handle tools and equipment. Good mechanics read many service and repair manuals to keep abreast of changes in automobile engineering. A pleasing personality is helpful in dealing with customers who are irate over repair bills or car breakdowns. Mechanics work independently and are able to see the results of their labor.

Capable and experienced mechanics in a large shop may advance to a supervisory position, such as repair shop foreman or service manager. Many mechanics open their own repair shops or gasoline service stations.

Employment Outlook

Employment of automobile mechanics is expected to increase moderately through the 1970's. In addition to the job openings resulting from employment growth, several thousand openings are expected each year from the need to replace experienced mechanics who retire or die. Job openings also will occur as some mechanics transfer to other occupations.

Employment is expected to increase because expansion of the driving age population, consumer purchasing power, and multicar ownership will create a demand for more automobiles. Employment of mechanics also is expected to grow because a greater number of automobiles will be equipped with exhaust emission control devices, air-conditioning, and other features that increase maintenance requirements.

Primarily because of greater efficiency in the shop, employment of mechanics is not expected to grow as rapidly as the number of automobiles. For example, increased mechanic specialization and growth in the use of test equipment (such as dynamometers and engine analyzers) should reduce the time needed to diagnose malfunctions and check the quality of repairs. In a growing number of large shops, mechanics skilled in operating dynamometers and other kinds of test equipment determine needed repairs, then route the automobiles to mechanics who specialize in a particular kind of repair work. Also expected to improve efficiency are greater emphasis on replacement rather than on repair of defective parts, better shop management, and improved training methods.

Earnings and Working Conditions

Skilled (journeymen) automobile mechanics employed by automobile dealers in 34 cities had average straight-time hourly earnings of $5.16, based on a survey in late 1969. Average hourly earnings of these workers in individual cities ranged from $3.62 in Providence–Pawtucket, R.I., to $6.13 in Detroit, Mich. Skilled mechanics usually earn between two and three times as much as inexperienced helpers and trainees.

A large proportion of the experienced mechanics employed by automobile dealers and independent repair shops are paid a commission, usually about 50 percent of the labor cost charged to the customer. Under this method, the mechanic's weekly earnings depend on the amount of work he is assigned and how fast he completes it. Employers frequently guarantee their commissioned mechanics a minimum weekly salary. Helpers and trainees usually are paid an hourly rate until they are sufficiently skilled to work on commission. Some mechanics—for example, those employed by organizations that repair their own fleets of automobiles—receive an hourly rate.

Most mechanics work between 40 and 48 hours a week but may work even longer during busy periods. Mechanics paid on an hourly basis frequently receive overtime rates for hours worked in excess of 40 a week.

Many employers of automobile mechanics provide holiday and vacation pay, and additional benefits such as life, health, and accident insurance. Some also contribute to retirement plans. Laundered uniforms are furnished free of charge by some employers.

Generally, a mechanic works indoors. Modern automobile repair shops are well ventilated, lighted, and heated, but older shops may not have these advantages.

The work of the mechanic frequently requires working with dirty and greasy parts, working in awkward positions, and lifting heavy objects. Minor cuts and bruises are common. Serious accidents usually are avoided by observing safety practices.

Some mechanics are members of labor unions. Among the unions organizing these workers are the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.).

Where To Go for More Information

For further information regarding work opportunities for automobile mechanics, inquiries should be directed to local employers such as automobile dealers and independent repair shops; locals of the unions previously mentioned; or the local office of the State employment service. The State employment service also may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of automobile mechanics may be obtained from:

Automotive Service Industry Association, 230 North Michigan Ave., Chicago, Ill. 60601.

Independent Garage Owners of America, Inc., 624 South Michigan Ave., Chicago, Ill. 60605.

National Automobile Dealers Association, 2000 K St. NW., Washington, D.C. 20006.

BOWLING-PIN-MACHINE MECHANICS

(D.O.T. 639.381 and 829.281)

Nature of the Work

Bowling-pin-machine (or automatic pinsetting) mechanics repair, maintain, and adjust the tens of thousands of pinsetting machines in use today. When a breakdown occurs, the mechanic determines its cause and makes the necessary adjustments or repairs. He may partially or completely disassemble components of a machine to repair or replace defective parts. After he reassembles the machine, he adjusts it for proper operation.

A pinsetting machine is a complex mechanism that automatically performs a series of operations—returns the bowling ball to the bowler, clears the pin deck of fallen pins, and conveys and distributes the pins to a pinsetting mechanism that resets them on the pin deck. Pinsetting machines are electrically powered and electrically or mechanically controlled.

A pinsetting machine mechanic maintains various gap or clearance adjustments in belts, chains, and other drive devices; adjusts the clutch and brakes; and inspects bearings, sliding surfaces, and shock absorbers. He also maintains electrically controlled systems.

Much of the mechanic's worktime is spent in preventive maintenance. He regularly inspects and tests pinsetting machines, and cleans, oils, greases, and adjusts them. In his work, the mechanic applies knowledge gained through training, on-the-job experience, and the use of operating and troubleshooting manuals.

When servicing mechanical equipment, the mechanic uses many different types of tools and equipment, such as pliers, wrenches, screwdrivers, hammers, portable hoists, and lubricating guns. In electrical maintenance and repair work, the mechanic may use soldering irons, feeler gages, and crimping tools. He uses continuity testers, ammeters, and voltmeters to test electrical circuits, relays, solenoids, transformers, and motors. To assist him in this work, he uses diagrams of electrical circuits. Often the mechanic will purchase his own set of handtools, but the employer usually supplies special tools.

The mechanic may supervise one or more assistant mechanics, trainees, and pinchasers. He is often called upon to instruct trainees in locating and correcting minor malfunctions in pinsetting machines. Such instruction includes demonstrating how the machine operates as well as disassembling components and explaining their function. He shows trainees and pinchasers how to break minor jams and recondition bowling pins. He also explains proper safety procedures.

Some clerical work is done by the mechanic. He maintains a stock of repair parts by keeping inventory records and ordering replacements when necessary. He also may keep records of machine breakdowns and estimate maintenance costs.

Places of Employment

About 6,000 mechanics were employed in 1970. Most worked in commercial bowling establishments. The remainder, about 5 percent, were employed by manufacturers of automatic pinsetting machines to install and service machines of bowling establishments. Although the primary responsibility of manufacturers' mechanics is to inspect equipment periodically for proper operation, they may be called in to repair major breakdowns that mechanics in bowling establishments cannot handle.

Although mechanics and their assistants are employed in every State, employment is concentrated in the more populated areas, where there are many bowling establishments. Of the more than 10,000 bowling establishments in operation in early 1970, the majority were located in New York, Pennsylvania, Illinois, Ohio, Michigan, California, Wisconsin, Minnesota, New Jersey, and Texas.

Training, Other Qualifications, and Advancement

Pinsetting machine mechanics usually start out as pinchasers, assisting mechanics in individual bowling establishments. Many pinchasers, who demonstrate mechanical ability and willingness to learn, become trainees and are sent to a mechanics' training school maintained by bowling-machine manufacturers. To become a trainee at a factory school, candidates are required to take written tests to determine their mechanical aptitude and personality traits. Usually, trainees must be at least 16 years old. Trainees' wages and expenses during the training period, which usually lasts 4 weeks, are paid by employers. Trainees study the structure and operation of machines manufactured by the firm operating the school and learn to locate typical sources of trouble. They learn preventive maintenance procedures, how to read wiring diagrams, and how to use the tools of the trade. Their training also includes actual repair work on demonstration machines. After attending factory schools, trainees usually need several months of on-the-job experience before they acquire the skills of the trade.

Trainees who do not attend factory schools acquire their skills on the job by observing experienced mechanics at work and by receiving instruction in machine operation and maintenance, typical malfunctions, and safety procedures. They also do actual repair work, progressing from simple to more complex jobs as their skills increase. Usually, 1 to 2 years of such training and experience is necessary for trainees to acquire mechanics' skills.

Employers prefer to hire pinchasers who are high school graduates, although many workers in this trade have not completed high school. Courses in electricity, blueprint reading, and machine repair are useful.

Qualified mechanic trainees employed in commercial bowling establishments may be promoted to assistant mechanic and then to head mechanic. Mechanics can become managers or proprietors of bowling establishments. Those who work for manufacturers may advance to the position of service manager or instructor in a training school.

A young person planning a career as a bowling-pin-machine mechanic should have good eyesight (including color vision), physical strength, and eye-hand coordination. He also should have mechanical abilities and like to work with his hands. The job requires a person who can work independently in an isolated area. Because speed is usually essential in repairing pinsetting ma-

chines, he should be capable of working under pressure.

Employment Outlook

Little or no change in the number of bowling-pin-machine mechanics is expected through the 1970's. However, many job openings will result each year to replace workers who retire, die, or leave their jobs for other reasons.

Trends in the growth of bowling facilities, as well as developments in pinsetting machine technology, will be a major influence in the employment of mechanics in the future. Although the demand for bowling facilities is likely to grow as a result of expanding population, rising income levels, and more leisure time for recreation, employment of mechanics is not likely to increase. Older pinsetting machines are being replaced by improved models which need less maintenance; thus mechanics are able to service a greater number of machines.

Earnings and Working Conditions

National wage data are not available for pinsetter mechanics, assistant mechanics, and pinchasers. However, wage data from union-management contracts in mid-1970 covering a large number of these workers in large metropolitan areas on the East and West Coasts and in the Midwest show a very wide range of pay rates. Straight-time hourly rates ranged from $2.15 to $3.75 for mechanics, from $1.84 to $3.14 for assistant mechanics, and from $1.53 to $2.45 for pinchasers.

On the East Coast and in the Midwest most mechanics and their assistants work a 48-hour, 6-day week. On the West Coast, most of them work a 40-hour, 5-day week. Nightwork and work on Sundays and holidays is common. Workers covered by union-management contracts receive premium pay for overtime. In addition, union-management agreements usually provide for 1 week paid vacation after a year's service, 2 weeks after 2 years' service, and 3 weeks after 5 years' service. These agreements also call for 4 to 8 paid holidays a year. Many contracts provide health insurance and pension plans financed entirely by employers.

Mechanics and their assistants work in a long, relatively narrow corridor at one end of a bowling establishment where the automatic machines are located. The work area includes space for a workbench. The workspace is usually well lighted and well ventilated, but quite noisy when the lanes are in operation. When making repairs and adjustments, repairmen frequently have to climb and balance their bodies on the framework of the pinsetting machines, and to stoop, kneel, crouch, and crawl around the machines. Mechanics employed by manufacturers to install and service pinsetting machines are required to do considerable traveling.

Repairmen usually are not required to wear any special safety devices, such as goggles. Safety guards are provided on the pin-setting machines, but workers are subject to common shop hazards, such as electrical shock, cuts, falls, and bruises. Repairmen often wear coveralls to protect themselves from grease and dirt.

Mechanics, assistant mechanics, and trainees employed in large metropolitan areas generally are members of unions; usually the Service Employees' International Union or the International Brotherhood of Teamsters, Chauffeurs, Warehousemen, and Helpers of America (Ind.).

Sources of Additional Information

A young man who wishes to obtain further information about training or work opportunities in this trade should contact proprietors of commercial bowling establishments in his area, the local bowling proprietors' association, or locals of the unions previously mentioned. The local office of the State employment service is another source of information about employment and training opportunities.

BUSINESS MACHINE SERVICEMEN

(D.O.T. 633.281 and 828.281)

Nature of the Work and Places of Employment

Business machine servicemen maintain and repair the increasing numbers and types of office equipment used for correspondence, for recording and processing transactions, and for duplicating and mailing information. Equipment used for these purposes includes typewriters, adding and calculating machines, cash registers, electronic computers and other data-processing devices, dictating and transcribing machines, and mailing, duplicating, copying, and microfilm equipment. These machines are becoming increasingly complex as electric and electronic control components are incorporated in them.

Servicemen do much of their

work in the offices where the machines are used. Servicemen may maintain this equipment on a regular basis, returning at frequent intervals to inspect the machines, to clean and oil them, and to make minor adjustments or repairs. They also may be called to an office to check or repair a defective machine. On office calls, servicemen usually question the operator about the condition of the machine. They often have to explain to operators how various features of the machines can best be used and how to avoid machine damage.

When inspecting business machines, the serviceman usually checks the operation of various parts of the equipment to see if they work properly or to find the source of reported trouble. For example, he may strike the keys of a typewriter or calculator, rotate the drum of a duplicating machine, or feed punchcards to a tabulator or sorter. In addition, he may check type or photographic devices for alinements and rollers for dryness or compactness. He may make voltage checks of electric or electronic components. The serviceman may take a machine to the company's servicing department for a major repair or overhaul.

In addition to common handtools, such as screwdrivers, pliers, and adjustable wrenches, business machine servicemen frequently use gauges and meters and other test equipment and tools designed for special purposes. In large service shops, servicemen use power tools such as drill presses, lathes, and other power equipment.

Business machine servicing offers considerable variety in work assignments. This work requires the application of analytical ability to a wide range of problems. Many persons find considerable satisfaction in being able to diagnose and correct the cause of trouble in a faulty machine. Some manufacturers' servicemen have the opportunity to evaluate and report on recommended improvements in new and existing company products.

Besides responsibilities for maintenance and repair, servicemen may engage in sales activities. Most commonly, they sell preventive maintenance contracts for machine servicing on a regular basis. Some servicemen also are expected to sell supplies, such as special paper, ink, ribbons, and stencils, used with particular machines.

Business machine servicemen are employed in several types of firms. Most of them work in the sales and service offices of business machine manufacturers; others, in independent business machine repair shops; the remainder, for large organizations that have enough machines to justify full-time servicemen.

In a manufacturer's branch office, servicemen usually work exclusively on the manufacturer's products. They specialize in one or two machines or service the full line of equipment. In a small city, specialization is impractical and most servicemen are "full-line." In these instances, service and selling new equipment usually are combined.

Servicemen employed by independent dealers maintain and repair the many makes and models of office machines used in the community. Most dealers sell and service typewriters. Some also sell and service adding machines, dictating machines, and less complex types of duplicating and copying equipment. Other dealers specialize in the sales and service of adding and calculating machines, cash registers, and bookkeeping-accounting machines. Most independent dealers employ fewer than five servicemen, although some large dealers may employ as many as 10 or 15.

Business machine servicing jobs are found throughout the country. Even relatively small communities usually have at least one or two shops which repair machines. However, most business machine servicemen work in large cities, where the majority of business machines are located.

Typewriter Servicemen (D.O.T. 633.281). The principal work of the estimated 19,000 typewriter servicemen employed in 1970 was the maintenance and repair of manual and electric typewriters. Typewriters are the most widely used business machines. They are used in almost every business office, as well as by many individuals in their homes. Though the operation of electric typewriters and mechanical typewriters differs, the two types are similar enough that, with additional training, the servicemen who specialize in the repair of mechanical typewriters usually can learn to repair the electric machines. Some servicemen maintain and repair more sophisticated equipment, such as tape-fed automatic typewriters and interchangeable typeface machines, some of which operate in conjunction with small computers. These machines are considerably more complicated than regular typewriters and extensive training, usually provided by the manufacturer, is required before servicemen may qualify to repair them.

Typewriter servicemen are employed both in the sales and service branches of typewriter manufacturers and by local independent dealers. Many servicemen operate their own maintenance and repair shops. Typewriter servicemen are found in almost every sizable community throughout the Nation.

Adding Machine Servicemen

(D.O.T. 633.281). In 1970, about 5,000 business machine servicemen worked mainly on adding machines which are less complex than most office machines. In some cases, servicing of both adding machines and calculators is done by the same employee. The repair of adding machines and simpler calculating machines often provides experience for advancement to work on more complicated equipment such as bookkeeping and accounting machines. In some independent establishments, adding machines are serviced by men who also repair typewriters.

Adding machine servicemen are employed both in manufacturers' sales and service branches and by independent dealers. Other sources of employment are Federal, State, and local governments, and a few large banks and other firms which use large numbers of adding machines.

Calculating Machine Servicemen (D.O.T. 633.281). About 10,000 calculating machine servicemen were employed in 1970. Calculating machines add, subtract, divide, multiply, and perform combinations of these operations. In some shops, servicing of calculators is combined with the servicing of other business machines, particularly adding machines and accounting-bookkeeping machines.

Most of the men who service calculators are employed in manufacturer's sales and service branches. Some independent dealers employ men skilled in the maintenance and repair of calculators. Others are employed by the Federal Government and some large business organizations.

Cash Register Servicemen (D.O.T. 633.281). Repairing cash registers was the main work of approximately 4,000 business machine servicemen in 1970. Next to typewriters, cash registers are the most widely used business machines. The simplest models merely record transactions, add receipts, and provide a change drawer. The more complicated cash registers simultaneously record several different kinds of information on each transaction (such as identification of the clerk, department, type of merchandise, payment given, and change due), provide printed receipts, and dispense change and trading stamps to the customer.

Most cash register servicemen work in the sales and service branches of the few manufacturing firms making these machines. Some of the repair work, especially in smaller communities, is done by independent dealers who also maintain and repair other business machines.

Accounting-Bookkeeping Machine Servicemen (D.O.T. 633.281). The repair of accounting-bookkeeping machines was the main work of more than 2,500 business machine servicemen in 1970. These machines perform a variety of operations. Some post entries and some do billing, but others combine the functions of typewriters and computing devices. All models have keyboards, like those on typewriters and adding machines. These machines are used in firms that have a great deal of accounting and bookkeeping work, such as department stores, large retail and wholesale businesses, and banks. Many of the newer models are adjusted to fit the accounting procedures used in an individual customer's office. Servicemen set up the controls or programs for these machines from plans which have

been devised by the customers and manufacturers' salesmen.

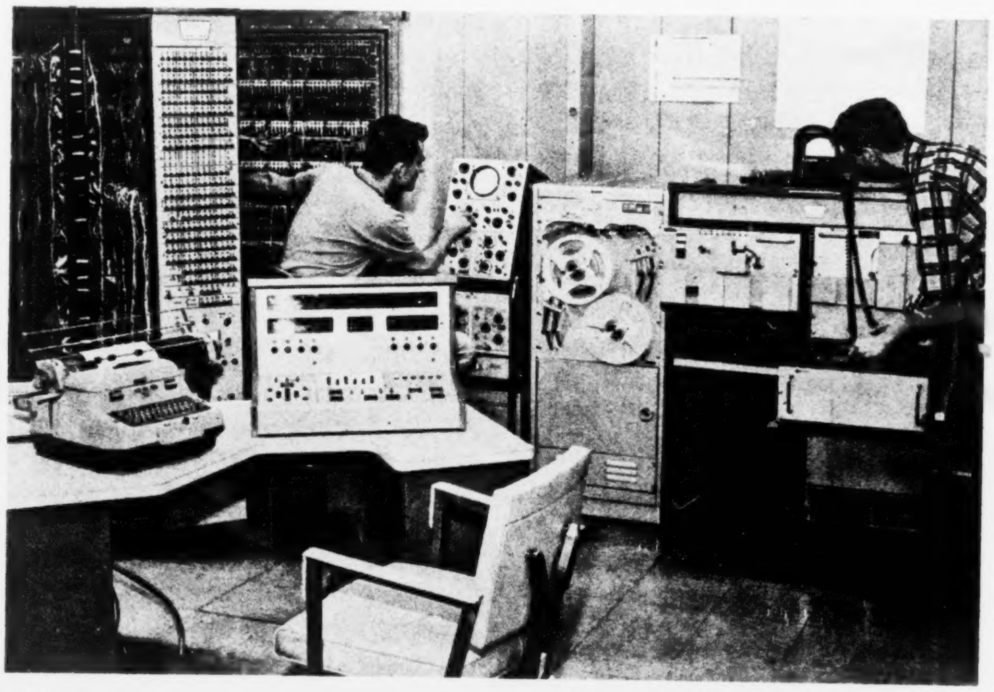
Most accounting-bookkeeping machine servicemen are employed in the sales and service branches of companies manufacturing this equipment. Very few work in independent repair shops.

Data-Processing Equipment Servicemen (D.O.T. 828.281). Nearly 30,000 men were employed in 1970 to install, modify, and maintain groups of machines (systems) used to process large volumes of accounting-statistical data. These men are the most skilled business machine servicemen and must have a good knowledge of electronics. The machines that they service include mechanical and electromechanical devices of varying complexity and highly complicated electronic computers. However, even those machine systems which include the most advanced computers depend to a high degree on associated equipment having electromechanical operating and control mechanisms. This auxiliary equipment feeds information to the computer for data processing and converts the processed data to printed form for immediate use and to magnetic tape and punchcards for recordkeeping and further processing. Machines used in data-processing systems include computers, tabulators, card punchers, sorters, collators, converters, tape transports, printers, and numerous other devices.

Data-processing machine servicemen are employed principally by firms which manufacture and service this equipment. They may work anywhere in the United States, but they are usually stationed in the larger cities. Some are assigned to a large system in one location; others have territories containing a number of machines or systems.

Dictating Machine Servicemen (D.O.T. 623.281). In 1970, about 700 men serviced machines which record dictation on disks, belts, or tape to be played back for typing. In addition to standard office dictating machines, servicemen install and maintain central recording and transcribing systems.

Dictating machine servicemen must have a knowledge of electronic fundamentals to maintain and repair sound-amplifying components of this equipment. Mechanical skills are essential in maintenance work on drive mechanisms needed to control the movement of the recording disk or belt.



Dictating machine servicemen are employed throughout the country with concentrations in the large business and commercial centers. Most servicemen work in the sales and service branches of business equipment manufacturers or for their distributors. Typewriter and adding machine servicemen employed by some independent dealers also service dictating machines.

Duplicating and Copying Machine Servicemen (D.O.T. 633.281). About 6,500 men were employed in 1970 to maintain and repair duplicating and copying machines. These machines are used to make one or more paper copies of printed or written information. The processes used in these machines range widely, from highly complex methods for large volume reproduction to relatively simple methods used in desk-top copiers.

The office duplicator is essentially an offset printing press requiring a special plate for reproduction. A serviceman should be familiar with basic printing principles and technologies. Frequently, an office duplicator is operated in conjunction with photomechanical plate making equipment that also may be serviced by the office duplicator serviceman.

The office copier is an electromechanical device which produces single or multiple copies direct from an original. The equipment used in a single process may vary considerably, from relatively simple hand-operated devices used to make up to five paper copies to highly complicated electromechanical machines which can quickly duplicate several hundred copies.

When servicing duplicating or copying machines, the serviceman adjusts, oils, repairs, or replaces parts such as rollers, belts, or gear mechanisms. If the equipment has electric or electronic components, he may check voltages to determine the need for adjustment or replacements of parts. He also may clean the machine so that it will function properly and produce clear copy.

Duplicating and copying machine servicemen employed by some companies also service microfilm equipment used in office operations. The maintenance and repair of paper-handling mechanisms used to speed the movement of documents, including drawings, through the photographic equipment is generally similar to that used in duplicating machines. The men who service this equipment, however, must understand the photographic process used in order to properly aline the optical devices so as to produce clear, sharp negatives.

Most duplicating and copying machine servicemen are employed in the branch sales and service offices of manufacturers or by their distributors.

Servicemen of Postage and Mailing Equipment (D.O.T. 633.281). More than 2,000 servicemen were employed in 1970 to maintain the many different types of office machines needed to handle the billions of pieces of mail sent each year by business firms in this country. These office machines included postage meters, addressing and imprinting machines, and folding and inserting equipment. Data-processing machines, used for tabulating and imprinting acount information, also are used in addressing operations where the volume of accounts justifies their use.

Servicemen who work on these predominantly electromechanical machines install the equipment and adjust, oil, clean, and repair or replace components to keep the equipment in working order. As with most paper handling equipment, rollers and other manipulating devices driven by belt or gear mechanisms are the components most frequently requiring maintenance. Since most postage and mailing equipment is electrically powered and an increasing number of machines use electric or electronic controls, the servicemen must have a basic knowledge of electricity. In addition, a knowledge of electronic theory is a decided advantage.

Most men who service postage and mailing equipment are employed in the branch offices of equipment manufacturers.

Training, Other Qualifications, and Advancement

Usually applicants for entrance jobs as business machine servicemen must have at least a high school education. Applicants who have not completed high school, however, are accepted by some companies if they can demonstrate superior mechanical aptitude or have had qualifying mechanical or electrical experience. Completion of high school becomes particularly important, however, when a serviceman has acquired basic skills and is seeking to work on more complex equipment or to be promoted to supervisor. Applicants interested in servicing complex electromechanical and electronic equipment are required to have 1 year or more of training or experience in mechanics or electronics to qualify.

Applicants for entrance jobs often have to pass one or more tests. The most frequently tested characteristic is mechanical aptitude, followed by a knowledge of basic electricity or electronics, manual dexterity, general intelligence and abstract reasoning. Good eyesight, including color vision, also is important.

Employers look for applicants who have a pleasant, cooperative manner. Most machine servicing is done in customers' offices and a serviceman's ability to do his work with the least interference to office routine is very important. A neat appearance and ability to converse effectively also are desired characteristics.

Some employers require business machine servicemen to be bonded. Applicants for these jobs must have a record of honesty and trustworthiness because, in their work servicemen are brought in proximity to large sums of money and other valuables in banks, offices, and other establishments. Servicemen also may collect money for services performed and office supplies delivered to their customers.

Young persons entering the business machine servicing field generally begin as trainees and acquire their skills through on-the-job training, work experience, and instruction in manufacturers' training schools. Courses in business machines maintenance and repair, conducted by some State and city vocational schools and by private correspondence schools, are available to trainees and others interested in this field of work. In addition, programs to train unemployed and underemployed workers as office machine servicemen were operating in several cities in 1970 under provisions of the Manpower Development and Training Act.

Business machine servicemen who are hired for work in a manufacturer's branch office are trained to service only the company's line of machines. Trainees usually attend company schools from several weeks to several months, depending on the type of machine they will service. They then receive from 1 to 3 years of practical experience and on-the-job training before they are considered fully qualified. During this period, they may occasionally go back to factory schools for additional training. Even after becoming skilled workers, they may return to school for special instruction in new business machine developments. In addition to training in company schools, servicemen at manufacturers' branch offices are encouraged to broaden their technical and general knowledge during their nonworking hours. Many companies provide full or partial tuition grants for a variety of courses at academic institutions, as well as for home-study courses in subjects related to the serviceman's work.

Men in independent establishments generally learn the trade by working with experienced servicemen who instruct them in the skills of the trade. Occasionally, men employed by an independent dealer who is authorized to sell and service a manufacturer's products will be sent to the manufacturer's school for training. Generally, however, men in independent shops receive little formal training.

Length of training depends on the kind of establishment in which a man is employed. In independent shops, the time required to become a skilled serviceman tends to be somewhat longer than in manufacturers' branches because of the greater variety of machines and the generally informal nature of the training.

The training period also varies in relation to the complexity of the equipment and the serviceman's ability to become thoroughly skilled in the maintenance, repair, and other activities associated with less complicated business machines, such as typewriters, adding machines, and some photocopy equipment. For the servicing of calculating machines, about 2 years of training and experience are required. Cash register repairmen learn their work in from 2½ to 3½ years, the last 6 months of which are usually spent in the company school. Skilled accounting-bookkeeping machine repairmen generally must have at least 3 to 4 years of training and experience. The first 1 to 2 years may consist of servicing adding machines, calculators, or cash registers, since this is considered valuable background for servicing accounting-bookkeeping machines.

Most machines used in data-processing systems contain electrical equipment; many have electronic components. The companies which manufacture and service these machines, therefore, usually require that applicants have some knowledge of electricity or electronics. In qualifying for employment in the maintenance of the complex electronic data-processing machines, college or technical institute courses in engineering are helpful, if not essential. Young veterans who have had electronics training in the Armed Forces are especially desired by employers in this field. Because of the complexity of some computer systems, these servicemen usually must have considerable analytical ability, as well as a broad technical background. For example, they may have to be familiar with computer programing to identify programing procedures as a possible cause of a malfunction. Applicants hired as trainees generally spend their first 2 months in on-the-job training. If they prove satisfactory, they are sent to a company school for a period of from 3 to 6 months. After completing the course, they work under supervision until they acquire enough skill to service and repair on their own. This period usually lasts from 12 to 18 months.

Business machine servicemen may move into sales positions where earnings usually are greater. In some cases, service and sales work are combined. Men who show exceptional abilities also have opportunities for promotion to foreman, service manager, or other supervisory positions, and to serviceman training or product engineering divisions of their companies. Experienced men sometimes open their own repair shops; men who work in the branch offices of some manufacturers are sometimes given sales franchises from the company and become independent dealers.

Employment Outlook

The rapidly growing business machine industry will provide many thousands of job openings for servicemen each year during the 1970's. Opportunities also will occur because of the need to replace experienced workmen who retire, die, or transfer to other fields of work.

The estimated 80,000 business machine servicemen in 1970 more than tripled the number employed during the mid-1950's. The rapid growth is expected to continue as many more types of office machines do all kinds of clerical work. In recent years, many technical changes have occurred in long-established types of business machines. For example, electric typewriters and adding machines have been replacing nonelectric machines. Greater use of complex equipment which requires additional maintenance has increased the need for servicemen, especially those who have a knowledge of electricity or electronics.

Opportunities for employment servicing electronic data processing equipment (computers and associated equipment) will be particularly favorable in the years ahead. As new uses develop and the economy expands and becomes more complex, computers will become increasingly useful to business, government, and other organizations.

Business machine servicemen have year-round employment—steadier than many other skilled trades. The office machines serviced by these men must be maintained, even when business slackens, since business records must be kept, correspondence carried on, and statistical reports prepared. Men who establish themselves in the business machine service field can expect continuing employment for many years.

Earnings and Working Conditions

Information obtained from a number of employers of business machine servicemen in 1970 indicated that experienced servicemen generally earned from $110 to $300 a week. Wages depend on geographic location, machine serviced, and the length of service with employers. Wages generally were lowest for men who repair only typewriters, adding machines, calculators, cash registers, or dictating machines. Rates usually were highest for men who service electronic data-processing equipment, accounting-bookkeeping machines, postage and mailing machines, and complex duplicating and copying equipment.

Trainees begin earning from $80 to $105 a week. As they become more skilled, their pay increases. Men having previous electronics training in the Armed Forces or civilian technical schools generally receive somewhat higher beginning wages. In addition, many business equipment manufacturers have a merit rating plan that provides for periodic review of employee salaries. The merit salary increases resulting from this review usually are based on the serviceman's ability, training, and customer relationship.

In addition to their salaries, servicemen in some companies receive commissions for selling supplies or service contracts. Many servicemen employed by manufacturers and independent dealers are covered by group life and hospitalization insurance plans and pension plans.

Servicing of business machines is cleaner and lighter then the work in most other mechanical trades. Servicemen generally wear business suits and perform most of their work in the offices where the machines are used. Work tools usually are supplied by the employer. The occupation is comparatively free from the danger of accidents. Some of these positions involve considerable traveling within the area served by the employer. For this reason, many employers require that servicemen own or have the use of a car. The serviceman generally is reimbursed for company use of his car on a mileage basis. Other servicemen may work in a very concentrated area, depending on the city size and the number of machines. Service representatives frequently find themselves working in a variety of environments. These include hospitals and laboratories, government offices, and military installations, and colleges and universities—as well as large industrial plants and business offices.

Source of Additional Information

Additional information about employment in the field of business machines servicing may be obtained from local dealers who sell and service typewriters, adding, and dictating machines, as well as from branch sales and service offices of equipment manufacturers. Technical and vocational schools that offer courses in electricity, electronics, or office machine maintenance and repair can provide helpful information about the kind of training needed to qualify as a business machine service man. In addition, the local office of the State employment serviceman will provide information about training programs under the Manpower Development and Training Act.

DIESEL MECHANICS

(D.O.T. 625.281)

Nature of the Work

Diesel mechanics repair and maintain diesel engines that power transportation equipment such as heavy trucks, buses, ships, boats, and locomotives; and construction equipment such as bulldozers, earthmovers, and cranes. In addition, they maintain and repair diesel farm tractors and a variety of other diesel-powered equipment, such as generators, compressors, and pumps, used in public utilities, oilwell drilling rigs, and irrigation.

Before making repairs, a diesel mechanic inspects and tests engine components to determine why an engine is not operating properly. After the cause of the trouble has been located, he repairs or replaces defective parts and makes necessary adjustments. Preventive maintenance—avoiding trouble before it starts—is another major responsibility. For example, he may periodically inspect, test, and adjust engine components. Many diesel mechanics make all types of diesel engine repairs; others specialize, for example, in rebuilding engines or in repairing fuel injection systems, turbochargers, cylinder heads, or starting systems. Some mechanics also repair large natural gas engines used to power generators, pumps, and other industrial equipment.

Diesel mechanics job titles often indicate the type of diesel-powered equipment the mechanics repair. For example, those who repair the diesel engines in trucks may be called truck mechanics (diesel). Those who work on construction equipment, such as bulldozers and earthmovers, are usually called heavy equipment mechanics (diesel). In addition to engine maintenance and repair, the mechanics listed above may work on other parts of diesel-powered equipment. For example, truck mechanics (diesel) may work on brake and steering systems, transmissions, and other truck parts. (See statement on Truck Mechanics and Bus Mechanics.)

Diesel mechanics use common handtools (such as pliers, wrenches, and screwdrivers), as well as special tools (including valve refacers and piston pin-fitting machines). In addition, they may use complex testing equipment, such as a dynamometer to measure engine power, and special fuel injection testing equipment. Mechanics may also use machine tools to make replacement parts for diesel-powered equipment. They use powered hoists and other equipment for lifting and moving heavy parts.

Places of Employment

In 1970, an estimated 85,000 persons repaired and maintained diesel engines and related equipment. Many are employed in service departments of distributors and dealers that sell diesel engines, farm and construction equipment, and trucks. Mechanics also work for companies and government agencies that repair and maintain their own diesel-powered equipment, such as local and intercity buslines, construction companies, trucking companies, railroads, and State highway departments. Other diesel mechanics are employed by manufacturers of diesel engines and independent repair shops that specialize in repair of diesel engines.

Diesel mechanics are employed in all parts of the country. Large numbers of these workers, however, are employed in California, New York, Illinois, and Texas—States where high levels of construction, commercial, industrial, and farming activity have resulted in the use of large numbers of diesel-powered machines.

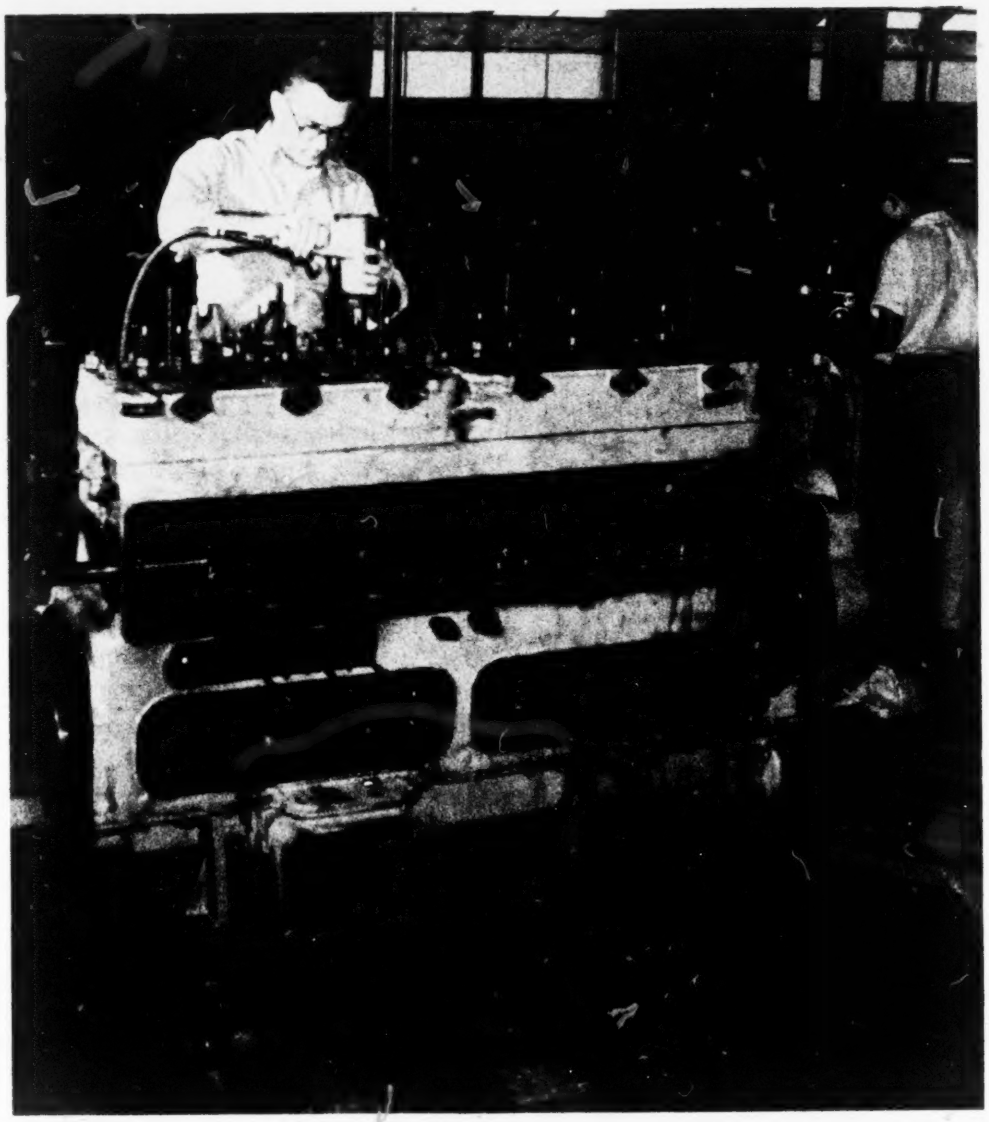
Training, Other Qualifications, and Advancement

Diesel mechanics learn their skills in several different ways. Most work first as mechanics repairing gasoline-powered automobiles, trucks, and buses. They usually start as helpers to experienced gasoline engine mechanics, becoming skilled in 3 or 4 years. When employed by firms that use or repair diesel-powered equipment, they are given 6 to 18 months of additional training in maintenance and repair of this equipment. While learning to fix diesel engines, many find it helpful to take courses in repair and maintenance of diesel equipment, offered by vocational, trade, and correspondence schools.

Some diesel mechanics, such as those employed by diesel engine manufacturers, learn their trade through formal apprenticeship programs. These programs, which generally last 4 years, give trainees a combination of classroom training and practical experience in repairing diesel engines. Apprentices receive classroom instruction in blueprint reading, hydraulics, welding, and other subjects. In their practical training, they learn about valves, bearings, injection systems, starting systems, cooling systems, and other parts of diesel engines.

Still another method of entry is through full-time attendance at trade or technical schools that offer comprehensive training in diesel engine maintenance and repair. These training programs generally last from several months to 2 years, and provide practical experience and related classroom instruction. Graduates, however, usually need additional on-the-job training before they become skilled mechanics.

Training programs for diesel mechanics and others in occupations that involve diesel engine repair work were in operation in several cities in 1970, under the provisions of the Manpower Development and Training Act. Unemployed and underemployed workers who meet certain minimum requirements are eligible to apply for this training,



Diesel mechanic reassembles engine after repair is completed.

which usually lasts at least 36 weeks.

Other young men learn the trade through less formal training programs. Generally, they are hired as trainees and are taught by experienced mechanics to do all kinds of diesel repair jobs.

Experienced diesel mechanics employed by companies that sell diesel-powered equipment are sometimes sent to special training classes conducted by diesel engine manufacturers. In these classes, mechanics learn to maintain and repair the latest diesel engines, using the most modern equipment.

Employers prefer to hire trainees and apprenticeship applicants who have a high school education as well as mechanical ability. Shop courses in automobile repair and machine-shop work, offered by many high schools and vocational schools, are helpful, as are courses in science and mathematics. Young persons interested in becoming diesel mechanics should be in good physical condition because the work often requires lifting heavy parts.

Many diesel mechanics are required to buy their own handtools. A beginner is expected to accumulate tools as he gains experience. Experienced mechanics usually have several hundred dollars invested in their tools.

Diesel mechanics who work for organizations that operate or repair large fleets of diesels, such as buslines or diesel equipment distributors, may advance to leadman and to supervisory positions such as shop foreman or service manager.

Employment Outlook

Employment of diesel mechanics is expected to increase very rapidly through the 1970's. In addition to employment growth, many job openings will result from the need to replace experienced mechanics who are promoted, retire, transfer to other fields of work, or die.

Increased employment of diesel mechanics is expected mainly because most industries that use diesel engines in large numbers are expected to expand their activities in the years ahead. In addition, diesel engines will continue to replace gasoline engines in a growing variety of equipment. For example, small delivery trucks powered by diesel engines are expected to be used increasingly in the future. Diesel-powered farm equipment will also become more common.

Most new job openings in this field will be filled by mechanics who have experience in repairing gasoline engines. Companies that replace gasoline engine equipment with diesel-powered equipment usually retrain their experienced mechanics to service the diesel equipment. Men who have school training in diesel repair, but no practical experience, may be able to find jobs only as trainees.

Earnings and Working Conditions

National wage data are not available for diesel mechanics. However, wage data collected from employers of workers who repair trucks, buses, construction equipment, and stationary engines, indicate that most diesel mechanics earned from $3.70 to $4.37 an hour in 1970.

The work schedule of diesel mechanics usually ranges from 40 to 48 hours a week. Many work at night or on weekends, particularly if they work on buses, diesel engines used in powerplants, or other diesel equipment used in serving the public. Some are subject to call for emergencies at any time. Diesel mechanics generally receive a higher rate of pay when they work overtime hours, evenings, or weekends.

Many diesel mechanics receive paid vacations and holidays. In addition, they may receive health and life insurance benefits, which are at least partially paid by their employers.

Most larger repair shops are pleasant places in which to work, but some small shops have poor lighting, heating, and ventilation. Diesel mechanics who work for buslines or construction companies sometimes make repairs outdoors where the breakdowns occur. If proper safety precautions are not taken, there is some danger of injury when repairing heavy parts supported on jacks or hoists. In most jobs, mechanics handle greasy tools and engine parts. It is sometimes necessary to stand or lie in awkward positions for extended periods of time.

Many diesel mechanics belong to labor unions such as the International Association of Machinists and Aerospace Workers; the Amalgamated Transit Union; the Sheet Metal Workers' International Association; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; and the International Brotherhood of Electrical Workers.

Sources of Additional Information

Young people who wish to obtain additional information about work opportunities in this trade should direct inquiries to the local office of the State employment service. Other sources are firms that use or service diesel-powered equipment, such as truck and buslines, truck dealers, and construction and farm equipment dealers. The State employment service also may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities. Unions listed below may be contacted for information on work and training opportunities or for the names and addresses of local unions that can provide such information:

International Association of Machinists and Aerospace Workers, 1300 Connecticut Ave. NW., Washington, D.C. 20036.

Sheet Metal Workers' International Association, 1000 Connecticut Ave. NW., Washington, D.C. 20036.

International Union, United Automobile, Aerospace and Agricultural Implement Workers of America, 8000 East Jefferson Ave., Detroit, Mich. 48214.

ELECTRIC SIGN SERVICEMEN

(D.O.T. 824.281)

Nature of the Work

Electric sign servicemen maintain and repair hundreds of thousands of neon and illuminated plastic signs that advertise names, products, and businesses. Some workers build, assemble, and install signs.

Electric sign servicemen diagnose trouble in improperly operating signs. Minor repairs, such as burned out lamps, are made at sign locations, whereas overhauls of faulty components, such as a motor, are made in sign shops.

In repairing neon signs servicemen may repaint portions of neon tubing to increase the readibility of the sign, tighten or weld parts loosened in high winds or dented during erection, and paint beams, columns, and other exterior framework.

In replacing burnedout ballasts in illuminated plastic signs, servicemen may refer to wiring diagrams and charts. Defective sockets usually appear cracked and are replaced. Small cracks in the face of the sign also may be repaired.

Electric sign servicemen also perform preventive maintenance. They check signs and remove such things as birds' nests and accumulated water. Also, gears, drives, pinions, bearings, and other parts of revolving signs may be checked, adjusted, and lubricated. Servicemen sometimes suggest to customers ways to increase the attractiveness and visibility of signs. For example, they may recommend changing the color of neon tubing, attaching flashers, or raising the height of a sign.

PLASTIC SIGNS
STORE FRONTS

Servicemen drive trucks equipped with the necessary tools such as wrenches, pliers, screw drivers, and tin snips. They also use test lamps and voltmeters. A boom crane may also be necessary for a very high sign.

Servicemen usually must fill out reports, noting the date, place, and nature of service calls. They also may estimate the cost of service calls and sell maintenance contracts to sign owners. Chief servicemen prepare work schedules for other electric sign servicemen.

Places of Employment

About 8,000 electric sign servicemen were employed in 1970, primarily in small shops that manufacture, install and service electric signs. Some servicemen also were employed in independent electric sign repair shops. Both types of shops may service signs that have been mass produced in large factories and shipped elsewhere for installation.

Electric sign servicemen are employed in every State. However, more than half are employed in New York, Illinois, California, Ohio, and Pennsylvania, where there are large numbers of industrial and commercial centers.

Training, Other Qualifications, and Advancement

Most electric sign servicemen are hired as trainees and learn their trade informally while on the job. Trainees rotate through the various phases of signmaking to obtain a general knowledge of sign fabrication—such as cutting and assembling metal and plastic signs; mounting neon tubing; wiring signs; and installing sockets, lamps, time switches, and photoelectric circuits. During each phase, they observe, work with, and receive instructions from experienced men. At least 3 years on the job are required to become a fully qualified service man. After completion of training, trainees are usually assigned to a permanent job, depending on their preferences and employers' needs.

Some servicemen learn their trade through electricians' apprentice programs, and specialize in signmaking and repairing. Applicants are generally required to be between 18 and 25, have mechanical aptitude, and an interest in electricity. These programs generally last from 3 to 5 years and include on-the-job training in signmaking and repairing, and classroom instruction is such fields as electrical theory and codes and blueprint reading. A few servicemen acquire their skills through special apprenticeships in sign contruction, erection, and servicing. Such programs usually include courses in metal and plastic sign fabrication, wiring of signs, installation techniques, and trouble shooting, in addition to similar courses taken by electrician apprentices.

Employers prefer trainees who are high school or vocational school graduates, although many sign servicemen have less education. Mathematics, science, electricity, and blueprint reading can be helpful to young people who are interested in learning this trade.

Servicemen need good color vision because electric wires are frequently identified by color. They also need manual dexterity to handle tools and physical strength to lift transformers, scaffolding, or equipment.

All electric sign servicemen must be familiar with the National Electric Codes; some also must know local electric codes. Many cities require servicemen to be licensed. Licenses can be obtained by passing a comprehensive examination in electrical theory and its application. Electric sign servicemen generally purchase their own handtools which may cost up to $100, but employers usually furnish power tools.

Highly skilled servicemen may become foremen. Because of their experience in servicing signs and dealing with customers, electric sign servicemen sometimes become sign salesmen. Also, servicemen with sufficient funds can open their own sign manufacturing or repair shops.

Employment Outlook

Employment of electric sign servicemen is expected to increase rapidly during the 1970's and produce several hundred new jobs annually. A few hundred openings also will result each year from the need to replace workers who retire, die, or transfer to other fields of work.

A rapid increase in the number of signs in use will spur demand for electric sign servicemen. New businesses, competition among businesses, and modernization of established enterprises will expand the number of new sign installations. In addition, many signs already in use will continue to require maintenance.

Employment, however, will not increase as rapidly as the number of signs in use. New equipment, such as highly versatile boom and ladder trucks, will speed servicing. Substitution of pressure cleaning equipment for manual methods also will increase efficiency.

Earnings and Working Conditions

The earnings of electric sign servicemen compare favorably with those of other skilled workers. According to a survey of wages and fringe benefits in 1970 covering 80 cities in 24 States, the average hourly union wage rate of experienced electric sign servicemen ranged from $2.50 to $6.44. In more than three-fourths of these cities, straight-time hourly earnings ranged between $4.00 and $6.00. Apprentice rates usually start at about half the journeyman's hourly wage rate and increase every 6 months, moving up to about 90 percent of the journeyman's rate during the final year of the program.

According to the survey, most electric sign servicemen worked an 8-hour day, 5 days a week, and received premium pay for overtime. In some cities, they also received premium pay for working at heights in excess of 30 feet. Servicemen received a week of paid vacation after 1 year's service, and 2 weeks or more thereafter, depending on the length of service. They also received from 6 to 9 paid holidays a year. In addition, many employers paid part or all of the cost of life, health, and accident insurance; some also contributed to retirement plans. When uniforms were required, the cost was usually partly or entirely paid for by the employer, who sometimes provided for their upkeep.

Because most signs are out-of-doors, servicemen are exposed to all kinds of weather. They make emergency repairs at night, on weekends, and on holidays. They often work from scaffolds, catwalks, and ladders; sometimes in awkward or cramped quarters. Some patrol areas at night for improperly operating signs. Hazards include electrical shock, burns, and falls from high places. Safety belts, training programs emphasizing safety, and baskets on boom trucks for easy access to signs have reduced the frequency of accidents.

Sources of Additional Information

For further information regarding work opportunities for electric sign servicemen, inquiries should be directed to local sign manufacturing shops, the local office of the State employment service, or locals of the International Brotherhood of Electrical Workers.

General information about the work of electric sign servicemen may be obtained from:

National Electric Sign Association, 600 Hunter Drive, Oak Brook, Ill. 60521.

FARM EQUIPMENT MECHANICS

(D.O.T. 624.281)

Nature of the Work

Much of the equipment used by farmers to plant, cultivate, and harvest food is serviced by farm equipment mechanics. These craftsmen maintain the electrical, mechanical, and hydraulic systems in all types of farm machinery such as tractors, combines, pick-up balers, corn pickers, crop dryers, field forage harvesters, elevators, and conveyors. In addition, they may assemble new farm implements and machinery that have been shipped in sections to farm equipment dealers or wholesalers. Sometimes, they may repair dented and torn sheet metal on farm equipment.

Much of the mechanic's time is spent repairing and adjusting diesel- and gas-powered tractors. When a tractor is malfunctioning, it may be driven or hauled to a shop. In planting or harvesting seasons, however, the mechanic may have to travel to the farm where the tractor is located. Often mechanics must make emergency repairs to equipment so that ripening crops can be harvested before they spoil.

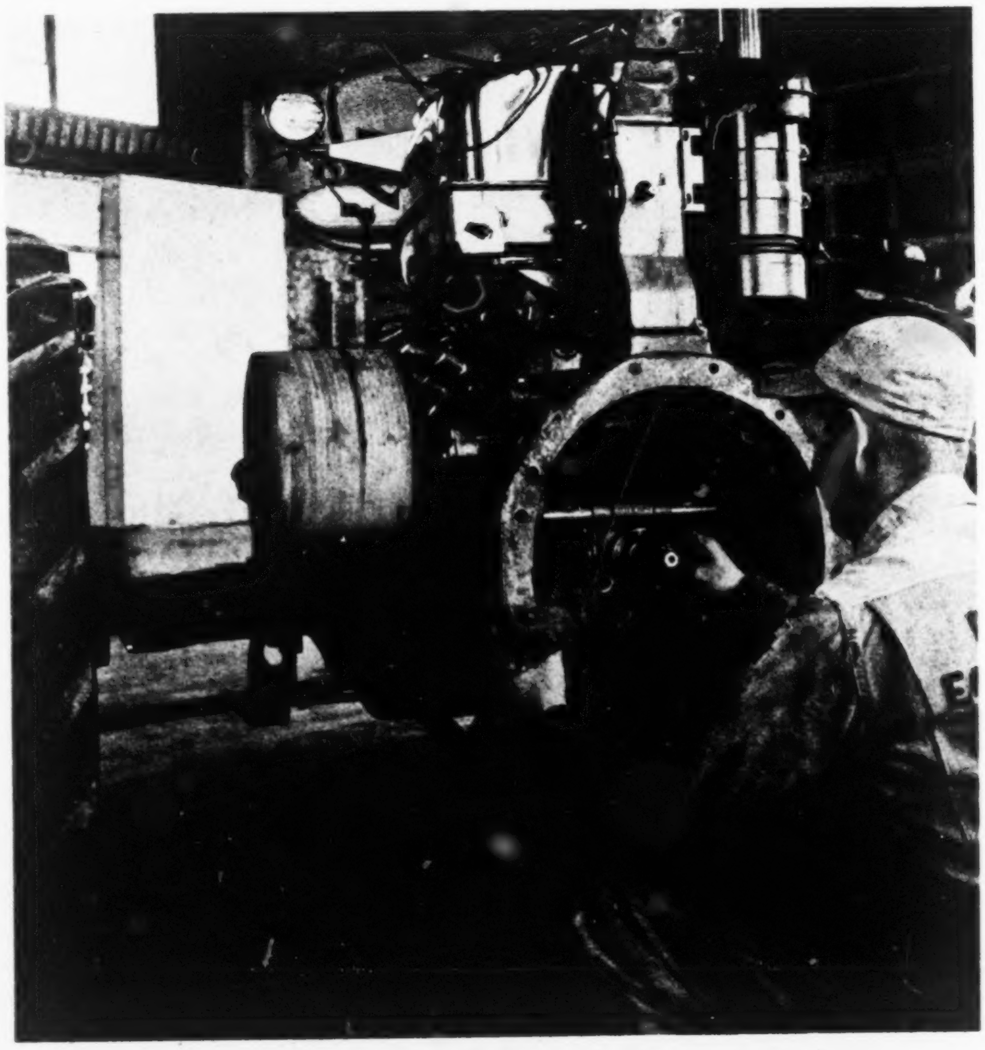
Farm equipment mechanics use a variety of testing equipment. For example, they may use a dynamometer, a device which measures engine performance. A compression tester also may be used to determine whether piston rings are worn or cylinder valves leak. After determining the cause of the trouble, mechanics make the necessary repairs. They may repair the transmission and tune or overhaul the engine completely. If parts of the engine are worn or broken, they may repair or replace them. They may use welding equipment or power metalworking tools to repair broken parts. They also use handtools such as wrenches, pliers, hammers, and micrometers.

Mechanics also perform preventive maintenance. Periodically, they test farm machinery parts, clean vital components, and tune engines. In large shops, mechanics may specialize in certain types of repair, such as engine overhaul or clutch and brake repair. They also may specialize in repairing certain types of equipment such as tractors or hay balers. Some farm equipment mechanics also repair plumbing, electrical, irrigation, and other equipment located on farms.

Places of Employment

Most of the estimated 53,000 farm equipment mechanics employed in 1970 worked in service departments of farm equipment dealers. These dealers sell and service new and used farm equipment. Other mechanics worked in independent repair shops, in repair shops on large farms, and in service departments of farm equipment wholesalers and manufacturers.

Most farm equipment repair shops employed fewer than five mechanics. These shops were located in the agricultural areas of the country. About half of the mechanics were employed in thirteen States:



Farm equipment mechanic assembles transmission shaft of tractor.

Illinois, Texas, Iowa, California, Minnesota, Indiana, Ohio, Missouri, Wisconsin, Nebraska, North Carolina, Pennsylvania, and Kansas.

Training, Other Qualifications, and Advancement

Most farm equipment mechanics are hired as helpers, and learn the trade by working on the job. As helpers, they assist qualified mechanics, assemble new farm equipment, and perform rough body repair work. The duration of on-the-job training varies with the helper's aptitude and prior experience. Some helpers can do simple repair jobs after 6 months. Generally, however, at least 3 years of on-the-job training are necessary to become a qualified mechanic.

A few mechanics also learn the trade by completing an apprenticeship training program. Apprentice trainees are usually chosen from among shop helpers. These programs last from 3 to 4 years and include on-the-job training in all phases of maintaining and repairing farm equipment and related classroom instruction. Upon completion of an apprenticeship program, trainees become qualified mechanics.

A small number of farm equipment mechanics also have received training in programs approved under the provisions of the Manpower Development and Training Act. Typically, these programs last between 29 and 56 weeks and include training in basic electricity, transmissions, welding, hydraulics, and diesel engines. Trainees who complete these programs make simple repairs and can qualify as skilled mechanics after some on-the-job experience.

Some farm equipment mechanics and trainees receive refresher training in short-term programs conducted by manufacturers of farm equipment. These programs usually last several days. A company representative explains the design and function of equipment, and teaches maintenance and repair on new models of farm equipment.

Employers prefer to hire young men with a farm background and an aptitude for mechanical work. They prefer high school graduates, but some employers will hire young men having less education. In general, employers stress previous experience or training in diesel and gasoline engines, hydraulics, and welding—subjects that may be learned in high schools and vocational schools.

A young person considering a career as a farm equipment mechanic should have strength and manual dexterity in order to handle tools and equipment. Good mechanics read many service and repair manuals to keep abreast of changes in farm equipment engineering. Mechanics work independently and are able to see the results of their labor.

Farm equipment mechanics may advance to shop foremen. Some open their own repair shops. Mechanics improve their opportunities for advancement by attending the manufacturer-sponsored training sessions.

Employment Outlook

Employment of farm equipment mechanics is expected to increase slowly through the 1970's. In addition to the openings that will arise from growth in the field, several hundred job openings will result each year from the need to replace experienced mechanics who retire, die, or transfer to other fields of work.

Employment requirements will be determined mainly by the number of farms, the extent of farm mechanization, and the increased reliability of new farm machinery—especially tractors which account for much of the repair work. The decrease in the number of farms and the increasing reliability of farm machinery are expected to limit the demand for farm equipment mechanics. These limiting factors will be partially offset, however, by the expected increases in farm mechanization, and the widespread adoption of specialized farm equipment such as the tomato harvester. Furthermore, farm operators will find it more economical to have their machinery serviced on a regular basis as farms become larger.

Earnings and Working Conditions

Wage data collected from a small number of employers indicated that in 1970 average hourly wages of farm equipment mechanics were generally between $2.30 and $3.85.

Farm equipment mechanics usually work a 44-hour week, which includes 4 hours on Saturday. During planting and harvesting seasons, however, they often work 6 to 7 days each week, 10 to 12 hours daily. In winter months, they may work fewer than 40 hours a week. Many mechanics receive from 1 to 2 weeks' paid vacation and 7 paid holidays each year. In large shops, farm equipment mechanics are usually covered by health plans and sometimes by retirement plans.

Farm equipment mechanics often travel many miles to repair equipment. When working in the field, they may be exposed to the elements. They come in contact with grease, gasoline, rust, dust, and dirt. There is danger of injury when they repair heavy parts which are supported on jacks or by hoists. Engine burns and cuts from sharp edges of farm implements are also possible.

The few farm equipment mechanics that belong to labor unions are members of the International Association of Machinists and Aerospace Workers.

Sources of Additional Information

Information about work opportunities in this trade may be obtained from the local offices of the various State employment services, local farm equipment dealers, and independent service shops. The State employment services also can provide information about programs set up under provisions of the Manpower Development and Training Act. General information about the occupation can be obtained from:

Farm and Industrial Equipment Institute, 850 Wrigley Building N., 410 North Michigan Ave., Chicago, Ill. 60611.

National Farm and Power Equipment Dealers Association, 2340 Hampton Ave., St. Louis, Mo. 63139.

INDUSTRIAL MACHINERY REPAIRMEN

(D.O.T. 625. through 632.281, and 637. through 639.281)

Nature of the Work

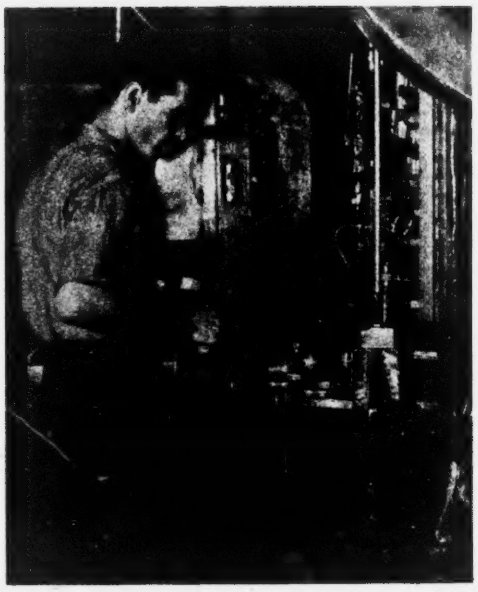
The great variety of machinery and equipment used throughout American industry is kept in efficient operating condition by industrial machinery repairmen—often called *maintenance mechanics*. These skilled workers maintain and repair machinery and other mechanical equipment used in a wide variety of factories. When breakdowns occur, repairmen must quickly determine the cause of the trouble, make the necessary repairs, and return the equipment to proper working order in minimum time. In this process, they may completely or partly disassemble a machine to repair or replace defective parts. After the machine is reassembled, they make the necessary adjustments to insure proper operation.

A repairman spends much time in preventive maintenance. By regularly inspecting the equipment, oiling and greasing machines, and cleaning and repairing parts, he prevents trouble which could cause breakdowns later. He also may keep maintenance records of the equipment he services.

The types of machinery on which industrial machinery repairmen work depend on the particular industry in which they are employed. For example, in the apparel industry, these skilled workers may repair industrial sewing machines. They may take sewing machines apart to repair belts, adjust treadles, or replace motor bearings. In printing and publishing establishments, repairmen may work on equipment such as printing presses and folders.

Repairmen often follow blueprints, lubrication charts, and engineering specifications in maintaining and repairing equipment. They also may use catalogs to order replacements for broken or defective parts. When parts are not readily available or the situation demands quick action to return a machine to production, repairmen may sketch a part that may be fabricated by the plant's machine shop.

Industrial machinery repairmen use wrenches, screwdrivers, pliers, and other handtools, as well as portable power tools. They also may use welding equipment in repairing broken metal parts.



Places of Employment

Industrial machinery repairmen work in almost every industrial plant that uses large amounts of machinery and equipment. However, most of the 180,000 repairmen estimated to be employed in 1970 worked in the following industries: food and kindred products, primary metals, machinery, chemicals, fabricated metal products, and transportation equipment. Many repairmen also were employed in the paper, electrical machinery, and rubber industries.

Because industrial machinery repairmen work in a wide variety of plants, they are employed in every section of the country. The largest numbers of these workers are found in New York, Pennsylvania, California, Ohio, Illinois, Michigan, New Jersey, Massachusetts, and other heavily industrialized States.

Training, Other Qualifications, and Advancement

Most workers who become industrial machinery repairmen start as helpers and pick up the skills of the trade informally through several years of experience. Others learn the trade through formal apprenticeship programs. Apprenticeship training usually lasts 4 years and consists of both on-the-job training and related classroom (or correspondence school) instruction. Apprentices learn the use and care of tools, and the operation, lubrication, and adjustment of the machinery and equipment which they will maintain. Classroom instruction is given in shop mathematics, blueprint reading, safety, hydraulics, welding, and other subjects related to the craft.

Mechanical aptitude and manual dexterity are important qualifications for workers in this trade. Good physical condition and agility also are necessary because repairmen are sometimes required to lift heavy objects or do considerable climbing in order to reach equipment located high above the floor.

High school courses in mechanical drawing, mathematics, and blueprint reading are recommended for those interested in entering this trade.

Employment Outlook

Employment of industrial machinery repairmen is expected to increase rapidly through the 1970's. In addition to employment growth, thousands of job openings will result from the need to replace experienced repairmen who transfer to other occupations, retire, or die.

Employment is expected to increase mainly because of the use of more machinery and equipment to fabricate, process, assemble, inspect, and handle industrial production materials. In addition, as automatic equipment and continuous production lines become more wide-spread, breakdowns will lead to possible greater losses of production and make repair work and preventive maintenance more essential.

Earnings and Working Conditions

Average straight-time hourly earnings of industrial machinery repairmen employed by manufacturing establishments in 86 metropolitan areas surveyed in 1969–70, ranged from $3.02 in Lubbock, Texas, to $4.50 in Detroit. Nearly two-thirds of the repairmen covered by these surveys earned $3.75 an hour or more. Straight-time hourly earnings for repairmen in 12 of the metropolitan areas, selected to present regional variations in wages, appear in the accompanying tabulation.

Metropolitan area	*Rate per hour*
Baltimore	$4.06
Boston	3.70
Chicago	3.18
Houston	4.14
Miami	3.23
Minneapolis–St. Paul	3.98
New York	4.26
Phoenix	3.90
Pittsburgh	3.91
San Francisco–Oakland	4.39
Seattle–Everett	4.35
South Bend	3.89

Apprentices usually begin at 50 percent to 65 percent of the journeyman rate and receive periodic increases until that rate is reached.

Industrial machinery repairmen are not usually affected by seasonal changes in production. During slack periods, when some production workers are laid off, repairmen are often retained. Many companies use repairmen to do major overhaul jobs during such periods.

In emergencies, industrial machinery repairmen may be called to the plant during off-duty hours. In some factories, repairmen may work nights and week-ends.

Because motors and other parts of machines are not always readily accessible, repairmen may work in stooped or cramped positions in limited quarters or from the tops of ladders. Repairmen are subject to common shop injuries such as cuts and bruises. However, accidents have been reduced by the use of goggles, metal-tip shoes, safety helmets, and other protective devices. Repairmen must frequently work on dirty and greasy equipment. Lighting and ventilation are usually good.

Most industrial machinery repairmen belong to labor unions. Some of the unions to which these workers belong are the United Steelworkers of America; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Association of Machinists and Aerospace Workers; and the International Union of Electrical, Radio and Machine Workers. Most employer-union contracts provide for paid holidays and vacations, health and life insurance, retirement pensions, and other fringe benefits.

INSTRUMENT REPAIRMEN

(D.O.T. 710.131; 710.281; 710.381; 710.884; 729.281; 823.281; and 828.281)

Nature of the Work

Instrument repairmen (also called instrument men) maintain

Instrument repairman adjusts water level control on terminal cracking unit.

the complex industrial and scientific instruments that measure, record, or control variables such as heat, electricity, pressure, liquid flow, and chemical composition. These workers service instruments used to refine oil, guide airplanes and missiles, generate electricity, conduct laboratory experiments, and manufacture a variety of consumer products. They also service a wide variety of instruments used in fields such as nuclear energy, oceanography, sewage and water treatment, pipeline transportation, medicine, dentistry, optics, and photography. Most repairmen service a variety of instruments; others specialize in electronic, hydraulic, or pneumatic instruments. Some repairmen install and test new instruments and advise operators on how to use and care for them.

When an instrument controlled system is not functioning correctly, instrument repairmen first determine whether the trouble is caused by a malfunction of the instrument itself or by other equipment connected to the instrument. They may disassemble malfunctioning instruments and examine and test mechanisms and circuitry for defects. They use testing equipment such as pressure and vacuum gages, speed counters, voltmeters, and ammeters. Readings shown on test equipment are compared with readings that would be shown if the instruments were operating properly.

Instrument repairmen work with instruments at the site of trouble or in specially equipped shops. They may perform major overhauls, replace worn or damaged parts, or make minor repairs such as resoldering loose connections. They use handtools such as screwdrivers, wrenches, pliers, and soldering irons, and bench tools such as jewelers' lathes, pin vises, small buffer grinders, and ultrasonic cleaners for small metal parts. In some companies, instrument repairmen operate drill presses, grinders, polishers, and other machine tools to make new parts or to change standard parts to fit particular instruments. When an instrument must be set to a precise tolerance, they may use jewelers loupes, micrometers, or microscopes. As guides in their work, instrument repairmen frequently use instruction books and maintenance manuals that describe how to install, operate, and maintain instruments. They also use schematic diagrams, assembly drawings, and blueprints. When instruments are reassembled, repairmen give them final checks for accurate operation.

Instrument repairmen follow preventive maintenance schedules to inspect and correct defects that might cause breakdowns and result in production losses. They also clean, lubricate, and adjust instruments.

Places of Employment

About 95,000 instrument repairmen were employed in 1970. Most of them worked for gas and electric utilities, petroleum and chemical plants, and manufacturers of instruments and industrial controls. Large numbers of instrument repairmen also were employed by airlines and by manufacturers of pulp and paper, metals, rubber, aircraft and missiles, and automobiles. A few thousand worked for Federal agencies, mainly the Air Force, Navy, and Army.

Training, Other Qualifications, and Advancement

At least 4 years of on-the-job training and study is usually required to become a fully qualified instrument repairman. However, training time may vary considerably, depending upon individual ability, previous experience and training, and complexity of the instruments serviced.

Instrument repairmen generally

are selected from production employees or hired as trainees. They may learn their trade informally by assisting experienced repairmen or through formal apprenticeship or other special on-the-job training programs. Apprenticeship programs generally last 4 years and in addition to actual work experience, may include courses in instrumentation theory, mathematics, blueprint reading, process theory, physics, electronics, and chemistry. These courses may be taken by correspondence or at local schools during or after working hours.

Some young men train for instrument repair work in technical institutes and junior colleges. Programs offered by these schools usually last about 2 years and emphasize basic engineering courses, science, and mathematics. As instruments become more complex, technical school training will become increasingly important and young men with this kind of training will have better advancement opportunities.

Armed Forces technical schools also offer training in instrument servicing. Young men who enter the Armed Forces may wish to investigate opportunities for training and work experience while in military service. Skills acquired in this way may help to qualify men for civilian jobs as instrument repairmen. A small number of unemployed and underemployed workers receive training under the Manpower Development and Training Act.

Several instrument manufacturers offer specialized training to experienced repairmen employed by their customers. This training generally lasts from 1 week to 9 months, depending upon the number and complexity of the instruments. Courses are given in theory, maintenance, and operation of the instruments produced by these manufacturers. Students learn how to check instruments and where to find further information about instrument servicing.

Men hired as trainees or apprentices generally must be high school graduates. Courses in algebra, trigonometry, physics, chemistry, electricity, electronics, machine-shop practice, and blueprint reading are considered particularly useful. Some employers give tests to applicants to determine their mechanical or electrical aptitude. Building and maintaining a ham radio station or stereo is good experience for an individual planning to become an instrument repairman, at least for electrically operated instrumentation.

Young people planning a career as instrument repairmen must have mechanical aptitude and above-average ability to read manuals and schematic drawings. Other important qualifications include ability to work with little supervision and to perform a variety of duties often characterized by frequent change. Instrument repairmen must be able to evaluate data revealed by tests and observations and to work to precise standards and tolerances. Good eye-hand coordination and finger dexterity are needed when handling delicate parts.

Instrument repairmen having supervisory ability may become group leaders or foremen in maintenance and repair departments. Some may advance to positions as service representatives in the branch offices of instrument manufacturing companies. A few instrument repairmen become engineering assistants. Because the use of electronic components in instruments is expected to increase, a basic knowledge of electronics may increase the possibility of advancement.

Employment Outlook

The number of instrument repairmen is expected to increase very rapidly through the 1970's. In addition to job openings resulting from growth, a few thousand openings will result annually from the need to replace experienced repairmen who retire, die, or transfer to other fields of work.

More instrument repairmen will be needed during the 1970's because the use of instruments is expected to increase significantly for a wide variety of scientific, industrial, and technical purposes. Rapid increases are expected in areas such as oceanography, air and water pollution monitoring, nuclear instrumentation, and in the health service field. The number of industrial instruments used for process control in industries such as metals, petroleum, chemicals, food, rubber, and paper also is expected to increase substantially. In addition, more instruments will be needed for research laboratories; flight and navigation systems of aircraft, missiles, and spacecraft; automotive repair shops; applications of laser technology; temperature control of commercial and residential buildings; and for optical applications.

Earnings and Working Conditions

Several union-management agreements in the paper and allied products and petroleum industries indicated that many instrument repairmen received between $2.93 and $4.77 an hour in 1970. Those specializing in the repair of electronic instruments often receive higher wages. Instrument repairmen employed by Federal agencies are paid about the same rates as those employed by private industry.

Most instrument repairmen work a 40-hour, 5-day week. Those employed in petroleum refineries and chemical plants that operate 24 hours a day and 7 days a week may work on any of three shifts or rotate among shifts. Repairmen also may be called to work with emergency crews nights, Sundays, and holidays. They receive premium pay for night and holiday work, and most companies provide holiday and vacation pay. Many companies provide additional employee benefits such as life insurance, hospitalization, medical and surgical insurance, sickness and accident insurance, and retirement pensions.

Working conditions for instrument repairmen vary from servicing instruments located on factory floors amid noise, oil, and fumes, to working at benches in quiet, clean, well-lighted repair shops. In some industries, such as chemical, petroleum, and steel, repairmen may be required to work outdoors. Those employed by instrument manufacturers may have to travel frequently.

Many instrument repairmen belong to unions, including the International Association of Machinists and Aerospace Workers; International Brotherhood of Electrical Workers; International Brotherhood of Pulp, Sulphite and Paper Mill Workers; International Chemical Workers Union; International Union of Electrical, Radio and Machine Workers; International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; Oil, Chemical and Atomic Workers International Union; and Utility Workers Union of America.

Sources of Additional Information

The local office of the State employment service may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities for persons who wish to enter this occupation. Additional information about training, as well as employment opportunities in the field of instrumentation, may be obtained from:

Instrument Society of America, 530 William Penn Pl., Pittsburgh, Pa. 15200.

Scientific Apparatus Makers Association, Process Measurement and Control Section, 370 Lexington Ave., New York, N.Y. 10017.

Inquiries concerning positions with the Federal Government should be made at the regional offices of the U.S. Civil Service Commission.

MAINTENANCE ELECTRICIANS

(D.O.T. 825.281 and 829.134 and .281)

Nature of the Work

Maintenance electricians (electrical repairmen) maintain and repair many different types of electrical equipment. In addition, they sometimes modify and install electrical equipment such as motors, transformers, generators, controls, instruments, and lighting systems used in industrial, commercial, and public establishments.

A large part of a maintenance electrician's work is preventive maintenance—periodic inspection of equipment to locate and repair defects before breakdowns occur. When trouble does occur, he must find and repair the faculty circuit or equipment quickly to prevent costly production losses and inconvenience. In emergencies, he may advise management whether immediate shutdown of equipment is necessary, or if continued operation would be hazardous.

In his daily work, the maintenance electrician completes many tasks. For example, he may make repairs by replacing units or parts such as wiring, fuses, circuit breakers, coils, or switches. When performing repair or installation work, the electrician may connect wires by splicing or by using mechanical connectors. He may measure, cut, bend, thread, and install conduits through which wires are run to outlets, panels, and boxes. He also may adjust equipment controls and check and adjust instruments.

The maintenance electrician uses devices such as test lamps, ammeters, volt-ohm meters, and oscilloscopes in testing electrical equipment and wiring. He sometimes works from blueprints, wiring diagrams, or other specifications. He may make mathematical computations to determine the current carrying capacities of electrical wiring and equipment. Maintenance electricians use pliers, screwdrivers, wire cutters, drills, reamers, conduit bending and threading tools, and other hand and power tools.

Although all maintenance electricians have the same basic skills, the nature of their work depends mainly on the size of the plant and the particular industry in which they work. In manufacturing plants, these workers usually maintain electrical equipment used in the manufacture of a particular product. For example, steel mills and aluminum plants require a large number of electricians to maintain the electrical and

Maintenance electrician rewinds armature.

electronic equipment used to power and control rolling mills, presses, and other production machinery. In plants that use large amounts of electrical equipment, electricians may specialize in the maintenance of particular types of equipment, such as motors, welding machines, or transformers. In small plants, electricians usually are responsible for all types of electrical repair work. Maintenance electricians employed in large office buildings, apartment houses, and hospitals maintain lighting systems and other electrical equipment, such as that used in air-conditioning systems.

Places of Employment

An estimated 250,000 maintenance electricians were employed throughout the country in 1970. More than half of these craftsmen were engaged in servicing equipment and machinery used in the manufacturing plants of industries such as transportation equipment, primary metal products, electrical and nonelectrical machinery, chemicals, and fabricated metal products.

Nonmanufacturing firms that employed large numbers of maintenance electricians included transportation, communications, and public utilities industries; services; and mining. Federal, State, and local governments also employed many of these skilled workers.

Maintenance electricians are employed in every State. Large numbers work in heavily industrialized States such as California, New York, Pennsylvania, Illinois, and Ohio.

Skilled workers in this occupation have the advantage of being able to transfer to maintenance electrician jobs in many different industries. After some additional training, they also may qualify as construction electricians.

Training, Other Qualifications, and Advancement

Maintenance electricians learn the skills of their trade through formal apprenticeship programs or by accumulating experience through informal on-the-job training. Training authorities generally agree that apprenticeship programs give trainees more thorough knowledge of the trade and improved job opportunities during their working life.

Apprenticeship programs for maintenance electricians usually last 4 years. Apprentices are given on-the-job training and related technical classroom instruction in subjects such as mathematics, electrical and electronic theory, and blueprint reading. Training may include motor repair, wire splicing, commercial and industrial wiring, installation of light and power equipment, installation and repair of electronic controls and circuits, and welding and brazing.

A young man employed in a plant as a helper to a skilled maintenance electrician gradually may acquire the skills of this craft by observing the electrician and following his instructions. Others learn the trade by working in the maintenance department of a plant and picking up some fundamentals of the job. By moving from job to job, they eventually acquire sufficient experience to qualify as skilled workers. However, it generally takes more than 4 years to become a maintenance electrician through informal on-the-job training.

A young man interested in becoming a maintenance electrician should include courses in mathematics (such as algebra and trigonometry) and basic science in his high school or vocational school curriculum. Because the electrician's craft is subject to constant technological change, many experienced electricians continue to acquire additional technical knowledge and learn new skills. For example, some maintenance electricians who entered the trade years ago must now learn basic electronics to service the new electronic equipment being introduced in the Nation's industrial establishments and large commercial and residential buildings.

In selecting apprentice applicants or trainees, employers look for young men who have manual dexterity and are interested in learning how electrical equipment functions. These young men also need good color vision because electrical wires are frequently identified by their different colors. Although great physical strength is not essential, agility and good health are important.

All maintenance electricians should be familiar with the National Electric Code; some must be familiar with local building codes. A growing number of cities and counties require maintenance electricians to be licensed. An electrician can obtain a license by passing a comprehensive examination that tests his knowledge of electrical theory and its application.

Skilled maintenance electricians may become foremen who supervise the work of other maintenance electricians or other maintenance personnel. Occasionally, they may advance to jobs such as plant electrical superintendent or plant maintenance superintendent.

Employment Outlook

Employment of maintenance electricians is expected to increase moderately through the 1970's. Most openings will occur from the need to replace journeymen who retire, die, or transfer to other fields. Retirements and deaths alone will result in several thousand job openings annually. In addition, a few thousand job openings are expected each year because of the growing volume of electrical and electronic equipment in use in industry.

Earnings and Working Conditions

In general, earnings of maintenance electricians compare favorably with those of other skilled workers. The average straight-time hourly earnings of maintenance electricians in establishments in 85 cities and areas in 1969–70 ranged from $3.07 in Manchester, N.H., to $5.29 in Chicago, Ill. In about four-fifths of the cities surveyed, however, average straight-time hourly earnings of these craftsmen ranged from $3.60 to $4.75.

In establishments that operate an apprenticeship program, apprentices start at about 60 percent of the journeyman's basic hourly pay rate. They receive increases every 6 months, rising to 85 or 90 percent of the journeyman's rate during the last period of apprenticeship.

During a single day, an electrician employed in a plant may repair electrical equipment both in a clean air-conditioned office and on the factory floor, surrounded by the noise, oil, and grease of machinery. Maintenance electricians may be required to climb ladders, work on scaffolds, or work in awkward or cramped positions when repairing or installing electrical equipment.

Because maintenance electricians often work near high-voltage industrial equipment, they must be alert and accurate when performing their duties. Errors in wiring installations could have dangerous consequences, both to the electrician and the operating employees. Safety principles, part of all electrician training programs, have greatly reduced the frequency of accidents. Maintenance electricians are taught to use protective equipment and clothing, to respect the destructive potential of electricity, and to handle small electrical fires.

Several labor unions have maintenance electricians in their membership. Many of these craftsmen are members of the International Brotherhood of Electrical Workers. Other unions to which maintenance electricians belong are the International Union of Electrical, Radio and Machine Workers; the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America (Ind.); and the United Steelworkers of America. Most labor-management contracts covering maintenance electricians provide major benefit programs that may include paid holidays and vacations; hospitalization, medical, and surgical insurance; life insurance; and retirement pensions.

Sources of Additional Information

A young man who wishes to obtain further information regarding electrician apprenticeships or other work opportunities in the trade should apply to local firms that employ maintenance electricians; to a local joint union-management apprenticeship committee, if there is one in his locality; or to the local office of the Bureau of Apprenticeship and Training, U.S. Department of Labor. In addition, the local office of the State employment service may be a source of information about training opportunities. Some State employment service offices provide services such as screening applicants and giving aptitude tests.

MILLWRIGHTS

(D.O.T. 638.281)

Nature of the Work

Millwrights are skilled craftsmen who move and install lathes, milling machines, automatic assembly equipment, and many other types of heavy industrial machinery. They must have a thorough knowledge of complex equipment to dismantle, reassemble, and aline it. In assembling machinery, millwrights fit bearings, aline gears and wheels, attach motors, and connect belts. Millwrights often construct concrete foundations and platforms or fabricate metal framework on which machinery is mounted. They must be able to read blueprints and work with wood, steel, concrete, and other building materials.

When moving machinery, millwrights use hoists, cranes, jacks, crowbars, wood blocking, and other rigging devices. In dismantling and assembling equipment, they use wrenches, screwdrivers, hammers and other handtools, and portable power tools. They use micrometers, calipers, squares, plumb bobs, and other devices to align and level machinery.

Millwrights employed by contract installation and construction companies install a wide variety of heavy machinery. Those employed in factories usually specialize in installing the particular types of machinery used by their employers. They may also maintain plant equipment such as conveyors and cranes. They may replace worn or broken belts, weld metal parts, and lubricating machinery.

Places of Employment

Most of the estimated 80,000 millwrights employed in 1970 worked in manufacturing. The greatest number were in primary metals, metalworking, paper, lumber, and chemical products industries. Most of the remaining were in construction.

Some millwrights are employed by companies that specialize in moving, installing, and maintaining industrial machinery on a contract basis. Others work for machinery manufacturers who employ millwrights to install their products in customers' plants.

Millwrights work in every State. However, about half of them are employed in the heavily industrialized States of Michigan, Ohio, Pennsylvania, Illinois, New York, and Indiana.

Training, Other Qualifications, and Advancement

Most workers who become millwrights start as helpers to skilled workers and learn the trade informally through several years of experience. Others learn the trade through formal apprenticeship programs. Apprenticeship programs generally last 4 years and include training in dismantling, moving, erecting, and repairing machinery. Apprentices are trained also in floor layout, carpentry, welding, rigging, and the use of structural steel, wood, and concrete. The apprenticeship program includes classroom instruction in shop mathematics, blueprint reading, hydraulics, electricity, and safety. Many companies require that applicants be high school graduates between 18 and 26.

High school courses in science, mathematics, mechanical drawing, and machine shop practice are useful to young men interested in becoming millwrights. Because millwrights often put together and take apart complicated machinery, mechanical aptitude is important. Strength and agility are also important because the work requires considerable lifting and climbing.

Employment Outlook

Employment of millwrights is expected to increase moderately through the 1970's. Factors expected to increase employment include construction of new plants, addition of new machinery, changes in plant layouts, and maintenance of increasing amounts of complex machinery.

In addition to new job openings created by industrial expansion and increased mechanization, a few thousand workers will be needed annually to replace millwrights who retire, die, or transfer to other occupations.

Earnings and Working Conditions

Earnings of millwrights vary by area and industry. According to a survey covering 44 metropolitan areas, average straight-time hourly earnings of millwrights in manufacturing ranged from $3.31 to $4.75 in 1969–70. More than two-thirds of these workers earned at least $4 an hour. Straight-time hourly earnings for millwrights in 12 of the areas, representing various regions of the country, appear in the accompanying tabulation.

City	*Rate per hour* *Industrial millwrights (manufacturing industries)*
Akron	$4.39
Boston	3.56
Buffalo	4.29
Fort Worth	3.61
Los Angeles–Long Beach and Anaheim–Santa Ana–Garden Grove	4.75
Louisville	4.50
Minneapolis–St. Paul	4.42
New Haven	3.41
New Orleans	4.09
Rockford	4.20
St. Louis	4.19
Trenton	4.50

Millwrights employed by contract installation companies and construction companies usually have higher wage rates than those in manufacturing. The minimum average hourly rates for millwrights under union contracts in construction ranged from $4.15 to $7.14 in 1969, according to a national survey of building trades workers in 68 large cities.

Apprentices generally start at 50 percent or more of the skilled worker's rate and increase to that rate by the end of their training period.

Millwrights employed by factories ordinarily work year round. Those employed by construction companies, contract installation companies and those that manufacture and install machinery may have periods of unemployment and frequently work away from home.

The work of millwrights involves certain hazards. For example, there are dangers of being struck by falling objects or by machinery that is being moved. There also is the danger of falling from high work places. In addition, millwrights are subject to the usual shop hazards, such as cuts and bruises. Accidents have been reduced by the use of protective devices, such as safety belts and hats.

Most millwrights belong to labor unions, among which are the International Association of Machinists and Aerospace Workers; United Brotherhood of Carpenters and Joiners of America (construction millwrights); United Steelworkers of America; International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; International Brotherhood of Pulp, Sulphite and Paper Mill Workers; and the International Union of Eelctrical, Radio and Machine Workers. Employer-union contracts usually provide for benefits such as paid holidays and vacations.

Sources of Additional Information

United Brotherhood of Carpenters and Joiners of America, 101 Constitution Ave. NW., Washington, D.C. 20001.

MOTORCYCLE MECHANICS

(D.O.T. 620.281 and .384)

Nature of the Work

More than 2 million Americans own motorcycles and motor scooters. Although many cycling enthusiasts repair their own vehicles, most rely on skilled mechanics.

Motorcycles, like automobiles, need periodic servicing to operate at peak efficiency. Spark plugs, ignition points, brakes, and many other parts that frequently get "out of whack" have to be adjusted or replaced. This routine servicing frequently represents the major part of the mechanic's work load. However, the mark of a skilled mechanic is his ability to diagnose major mechanical and electrical problems and make necessary repairs in a minimum of time.

In diagnosing malfunctions, the mechanic first obtains a description of the symptoms from the motorcycle owner, and then runs the engine or test rides the machine. He may have to use special testing equipment and disassemble some components for further examination. Once defective parts are located, adjustments or replacements are made. Some jobs require only the replacement of a single item, such as a carburetor or generator, and may be completed in less than an hour. In contrast, an overhaul may require several hours because the mechanic must disassemble and reassemble the engine to replace worn valves, pistons, bearings, and other internal parts.

Mechanics use common handtools such as wrenches, pliers, and screwdrivers, as well as special tools for getting at "hard to remove parts" such as flywheels and bearings. They also use compression gauges, timing lights, and other kinds of testing devices. Hoists are used to lift heavy motorcycles.

Most mechanics specialize in servicing only a few of the more than 30 brands of motorcycles and motor scooters. In large shops, some mechanics specialize in overhauling and rebuilding engines and transmissions, but most are expected to perform all kinds of repairs. Mechanics may occasionally repair mini-bikes, go-carts, snowmobiles, outboard boat motors, lawn mowers, and other equipment powered by small gasoline engines.

Places of Employment

Nearly all of the estimated 5,000 full-time and 1,500 part-time motorcycle mechanics employed in early 1970 worked for motorcycle dealers. Most of the remainder maintained police motorcycles for municipal governments. A small number of mechanics were employed by firms that specialized in modifying or "customizing" motorcycles. Most shops employ fewer than five mechanics.

By State, employment is distributed much the same as motorcycle registrations. About one-half of the registrations in 1970 were in seven States: California, Michigan, Texas, Pennsylvania, Ohio, Illinois, and New York.

Nearly all mechanics who specialize in repairing motorcycles are employed in cities having more than 30,000 population. In smaller cities, motorcycles usually are repaired by mechanics who repair all kinds of equipment powered by small gasoline engines.

Training, Other Qualifications, and Advancement

Motorcycle mechanics learn their trade on the job. Trainees pick up their skills from experienced workers. Initially, a trainee learns to uncrate, assemble, and road test new motorcycles. Next, he learns routine maintenance jobs such as adjusting brakes, spark plugs, and ignition points. As the trainee gains experience, he progresses to more difficult tasks such as repairing electrical systems and overhauling engines and transmissions. Generally, 2 to 3 years on the job are necessary before a trainee becomes a fully qualified mechanic.

A trainee is expected to accumulate handtools as he gains experi-

Motorcycle mechanic overhauls engine.

ence. Mechanics usually have several hundred dollars invested in tools.

Employers sometimes send mechanics and experienced trainees to special training courses conducted by motorcycle manufacturers and importers. These courses, which may last as long as 2 weeks, are designed to upgrade the worker's skills and provide information on repairing new models.

When hiring trainees, employers look particularly for cycling enthusiasts who have gained practical experience repairing their own motorcycles. However, many employers will hire young men with no riding experience if they have mechanical aptitude and show an interest in learning the work. Trainees must be free of any physical disabilities that would prevent their obtaining a motorcycle driver's license.

Most employers prefer high school graduates, but will accept applicants with less education. Courses in small engine repair—offered by some high schools and vocational schools—generally are helpful, as are courses in automobile mechanics, science, and mathematics. While in school, a young man may work part time as a mechanic trainee. Many motorcycle dealers employ students, especially during the summer, to help assemble new motorcycles and perform minor repairs.

Public schools in several large cities offer post-secondary and adult education in small engine repair; a few schools in California have special courses in motorcycle repair. Some unemployed and under-employed workers have received training in small engine repair under the Manpower Development and Training Act.

The skills learned through repairing motorcycles can be transferred to other fields of mechanical work. For example, since all internal combustion engines are similar, a motorcycle mechanic can become an automobile or diesel mechanic after some additional training. However, such a transfer would not necessarily mean higher earnings.

Motorcycle mechanics, have limited advancement possibilities. Those with supervisory ability may advance to service manager and, eventually, to general manager in large dealerships. Managers who have the necessary capital may become dealers.

Employment Outlook

Employment in this relatively small occupation is expected to grow rapidly through the 1970's and create a few hundred job openings for full-time motorcycle mechanics each year. Many additional openings will arise from the need to replace experienced mechanics who retire, die, or transfer to other fields of work.

The number of motorcycles in use, the primary determinant of the demand for mechanics, quadrupled between 1960 and 1969. This dramatic increase resulted largely from a surge in the sale of imported motorcycles, particularly the small, inexpensive machines which were introduced in this country in the late 1950's. Favorable market conditions also were an important factor behind the rise in sales. Reflecting the large birth rate after World War II, the young adult population grew rapidly during the 1960's. Personal income levels also rose rapidly and made more money available for recreation. In addition, advertising designed to overcome an unfavorable public attitude toward motorcycling boosted sales.

The growth of motorcycles in use is expected to continue through the 1970's, but at a considerably slower pace than during the previous decade. Increases in the young adult population and personal income levels will create a demand for more motorcycles, and additional mechanics will be needed to maintain these machines. Growth in the numbers of mini-bikes and snowmobiles also will stimulate the demand for mechanics.

Maintenance per motorcycle may rise during the next decade as a result of a trend to higher powered, more complex engines. However, this favorable employment effect likely will be offset by increases in mechanic efficiency brought about by improved training methods, better shop management, and greater use of special tools and test equipment.

Earnings and Working Conditions

Earnings of motorcycle mechanics and trainees vary widely and depend on level of skill, geographic location, and employer. Limited information indicates that mechanics employed by motorcycle dealers earned between $2.50 and $5.50 an hour in early 1970, or 2 to 3 times as much as inexperienced trainees.

Some mechanics are paid an hourly rate or weekly salary. Others are paid a percentage—usually about 50 percent—of the labor cost charged to the customer. If a mechanic is paid on a percentage basis, his salary depends on the amount of work he is assigned and how fast he completes it. Trainees frequently are paid on a piecework basis when uncrating and assembling new motorcycles. At other times, they are paid an hourly rate or weekly salary.

Motorcycling increases sharply as the weather grows warmer. Consequently, most mechanics work more than 40 hours a week during the summer. Employers often hire additional mechanics and trainees to help handle the increased work load. Many of these temporary workers are part time and are laid off in the fall. However, a large proportion are students or have full-time jobs elsewhere.

Many motorcycle mechanics receive holiday and vacation pay and additional benefits such as life, health, and accident insurance. Some also receive paid sick leave, contributions to retirement plans, and laundered uniforms.

Motorcycle shops generally are well-lighted and ventilated, but are noisy when engines are being tested. The work is not hazardous, although mechanics are subject to cuts, bruises, and other minor injuries. Since motorcycles are relatively light-weight and have easily accessible parts, mechanics rarely do heavy lifting or work in awkward positions.

A small percentage of motorcycle mechanics are members of the International Association of Machinists and Aerospace Workers.

Sources of Additional Information

For further information regarding employment opportunities for motorcycle mechanics, inquiries should be directed to local motorcycle dealers or the local office of the State employment service.

TELEVISION AND RADIO SERVICE TECHNICIANS

(D.O.T. 720.281)

Nature of the Work

Skilled television and radio service technicians use their knowledge of electrical and electronic parts and circuits to install and repair a growing number of electronic products. Of these, television sets are by far the most prominent. Other major electronic products are radios (including home, automobile, and two-way mobile radios), phonographs, hi-fidelity and stereophonic sound equipment, intercommunication equipment, tape recorders, and public address systems. Many service technicians specialize in repairing one kind of equipment; for example, color television sets or automobile radios.

Most of the skilled work done by television and radio service technicians involves diagnosing trouble in equipment and making necessary repairs. Equipment may operate unsatisfactorily or break down completely because of faulty tubes, transistors, and other components; poor connections; aging of parts; or dirt, moisture, and heat. The service technician's job is to check and evaluate each possible cause of trouble; they begin with the simplest and most common cause—tube failure. In other routine checks, they look for loose or broken connections and for parts that are charred or burned, due to excessive current or mishandling.

When routine checks do not locate the cause of trouble, service technicians use test equipment to check suspected circuits. For example, they may measure voltages until an unusual or irregular measurement indicates the part causing trouble. Commonly used test instruments are vacuum tube voltmeters, multimeters, oscilloscopes, and signal generators.

On service calls, service technicians advise customers as to what may be wrong with television sets and whether sets must be taken to shops for further analysis and repair. If possible, they explain what repairs must be made and estimate the cost.

Technicians make simple electrical checks with a voltmeter, change tubes, and make necessary adjustments, including focusing the picture or correcting the color balance on color sets. They check high voltage circuits in color TV sets for excessive X-ray radiation. Service technicians who make customer service calls carry tubes and other components that are easily replaced in the customer's home. Apprentices or less experienced television service technicians may install or repair antennas on roofs or in attics and run lead-in wires from antennas to receivers.

Radios, portable televisions, and other small equipment usually are repaired in service shops. Larger television sets are repaired in shops when trouble develops only after a few hours of operation, or when the trouble must be located with more complex test equipment available in shops.

Television and radio service technicians usually refer to wiring diagrams and service manuals that show connections within sets, provide adjustment information, and describe causes of trouble associated with unusual symptoms. They must know how to use soldering irons, wire cutters, long-nosed pliers, wrenches, screwdrivers and, sometimes, magnifying glasses when they remove, adjust, or replace parts, components, or complete equipment such as automobile radios.

Places of Employment

More than 130,000 television and radio service technicians were estimated to be employed in 1970, of whom about one-third were self-employed. About three-fourths of all service technicians worked in service shops or in stores that sell and service television sets, radios, and other electronic products. Many of the remaining service technicians were employed by manufacturers, including their service branches.

Television and radio service technicians work in almost every city. However, employment is distributed geographically in much the same way as the Nation's population. Thus, they are employed mainly in the highly populated States and major metropolitan areas.

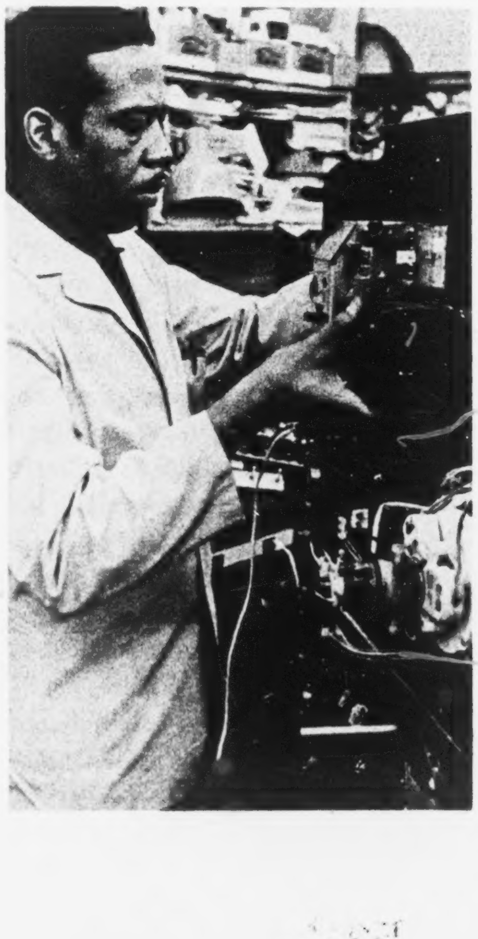
Training, Other Qualifications, and Advancement

Training in electronics is required to become a highly skilled television and radio service technician capable of working on various types of electronic equipment. Technical, vocational, or high school training in electronic subjects, mathematics, and physics has helped men to qualify as expert television and radio service technicians. The military service offers training and work experience that is useful in civilian electronics work. Home study (correspondence school) courses are also helpful.

From 2 to 4 years' combined training and on-the-job experience are required to become a qualified television and radio service technician. Men without previous training may be hired as helpers or apprentices if they show aptitude for the work or, like the amateur ("ham") radio operator, have a hobby in electronics.

An important part of the service technicians' training is provided by many manufacturers, employers, and trade associations. These organizations conduct training programs when new models or new products are introduced, as part of a continuing effort to keep service technicians abreast of the latest technical servicing and business methods. Service technicians also keep up with technical developments by studying manufacturers' instruction books and technical magazines, and by attending training meetings covering electronics service work.

Programs to train unemployed and underemployed workers for entry jobs in the television and radio service field were in operation in several States in 1970 under the Manpower Development and Training Act. These programs usually lasted from about 6 months to a year. Given additional experience or training, which may include an apprenticeship, graduates of these programs may become skilled service technicians.



Television and radio service technicians must know how electronic components and circuits work, and why they function as they do. They also must be able to understand technical publications. Other essential qualifications include the ability to manipulate small parts and tools, good hand-eye coordination, normal hearing, and good eyesight and color vision.

Television and radio service technicians who work in large repair shops or service centers may be promoted to assistant foreman, foreman, and service manager. Frequently, they are able to obtain jobs as electronic mechanics or technicians in manufacturing industries or government agencies. Those who are employed by manufacturers can advance to higher paying occupations such as technical writer, sales engineer, design engineer, and service training instructor. In addition, experienced men who have sufficient funds, adequate business management training, and ability may open their own sales and repair shops.

Persons interested in advancing to positions such as electronic technician can improve their opportunities by taking trade school, correspondence, or technical institute courses in automatic controls, electronic engineering, television engineering, mathematics, and related subjects.

In 1969, several cities and four States—Indiana, Connecticut, Louisiana, and Massachusetts—required that radio and television technicians be licensed. To obtain a license, applicants are required to pass an examination designed to test their skill in the use of testing equipment and their knowledge of electronic circuits and components.

Employment Outlook

Employment of television and radio service technicians is expected to increase rapidly through the 1970's. In addition to the openings that will arise from growth, thousands of job openings will result annually from the need to replace experienced service technicians who retire, die, or transfer to other fields of work.

Employment of service technicians is expected to increase in response to the growing number of radios, televisions, phonographs, and other home entertainment products in use. Factors that will contribute to this growth include rising population and family formations, and rising levels of personal income. In 1970, over 95 percent of all households had at least one television. During the next decade, the number of households with two television sets or more is expected to increase significantly, mainly because of the growing demand for color and lightweight, portable television sets. Other consumer electronics products that are expected to be used increasingly include stereo equipment and tape recorder devices such as cartridge and cassette units. New consumer products, such as home video tape recorders, as well as improved styling and design of existing products, also will stimulate demand. Greater use of nonentertainment products, such as closed-circuit television, two-way radios, and various medical electronic devices, also is expected. For example, closed-circuit television is being used increasingly to monitor production processes in manufacturing plants, and to bring educational programs into classrooms.

Employment of service technicians is not expected to increase as rapidly as the use of televisions and other consumer electronic products. Replacement of tubes with transistors and use of printed circuit boards instead of handwired chassis have lengthened the time a product may be operated before requiring service. Technological changes are expected to continue to reduce servicing requirements. Such changes, however, as well as the increasing miniaturization of components usually require servicemen to have greater skill and technical knowledge.

Earnings and Working Conditions

National earnings data are not available for television and radio service technicians. However, wage data obtained from more than one hundred union-management contracts, in effect in early 1970, indicated that experienced radio and television service technicians covered by these contracts averaged $3.50 to $6.50 an hour. The wide variations in wage rates reflect differences in type of employer, geographic location, and skill levels.

Television and radio service technicians employed in local service shops or dealer service departments commonly work a 6-day, 48-hour week. In large shops, including manufacturers' service branches, they usually work a basic 40-hour week. Service technicians often work more than 8 hours a day and receive higher rates of pay for overtime work. Some employers of television and radio service technicians provide paid vacations and holidays after a specified length of service. Many also provide or help pay for health and life insurance benefits.

Service on television, radio, and other home entertainment products is performed in shops and homes where working conditions are usually pleasant. Inside men work at benches, normally provided with stools. Outside men may spend several hours a day driving between shops and customers. Some physical strain is involved in lifting and carrying receivers. Perhaps the greatest hazards are the risk of falling from roofs while installing or repairing antennas, and electrical shock.

Some raido and television service technicians are members of labor unions. Most of them belong to the International Brotherhood of Electrical Workers.

Sources of Additional Information

Additional information about jobs in television servicing may be obtained from local service technicians, local dealers who sell and service television receivers and other electronic equipment, local television service associations, and manufacturers who operate their own service centers. Technical and vocational schools that offer courses in television and radio repair, or electronics, can provide helpful information about training. In addition, the local office of the State employment service would be a source of information about the Manpower Development and Training Act and other programs that provide training opportunities.

Information about the work of television and radio service technicians may also be obtained from:

National Alliance of Television Associations, 5908 South Troy St.
Chicago, Ill. 60629.

TRUCK MECHANICS AND BUS MECHANICS

(D.O.T. 620.281)

Nature of the Work

Truck and bus mechanics keep the Nation's trucks and buses in good operating condition. Truck mechanics maintain and repair heavy trucks used for mining, construction, and intercity travel; and small trucks used for local hauling. Bus mechanics maintain and repair transcontinental buses as well as those used for local transit. Although many parts of large trucks and buses are similar to automobile parts, truck and bus mechanics repair large engines, complex transmissions and differentials, airbrakes, and other components that are different from those in automobiles.

Mechanics employed by organizations that maintain their own vehicles may spend much time doing preventive maintenance to assure safe vehicle operation, prevent wear and damage to parts, and reduce costly breakdowns. During a maintenance check, mechanics inspect brake systems, steering mechanisms, wheel bearings, universal joints, and other parts, and make needed repairs and adjustments.

In large shops, mechanics may specialize in one or two kinds of repair. For example, some mechanics specialize in major engine or transmission repair. If an engine is to be rebuilt, the mechanic removes it from the vehicle and disassembles it. He examines parts, such as valves or pistons, for wear, and replaces or repairs defective parts. Many mechanics specialize in diesel engines that power large trucks and buses. Diesel and gasoline engines are similar but have different fuel and ignition systems. A mechanic who has worked only on gasoline engines needs special training to qualify as a diesel mechanic. (See statement on Diesel Mechanics elsewhere in the *Handbook*.)

Truck and bus mechanics use common handtools such as screwdrivers and pliers; power and machine tools such as pneumatic wrenches and drills; special purpose tools, such as pump seal installers and transmission jacks; and welding and flame cutting equipment. They also use testing equipment, such as oscilloscopes and dynamometers, to locate malfunctions, and hydraulic jacks and hoists to lift and move heavy parts.

When performing heavy work, such as removing engines and transmissions, two mechanics may work as a team, or a skilled mechanic may be assisted by an apprentice or helper. Mechanics generally work under the supervision of a shop foreman or service manager.

Places of Employment

A large proportion of the nearly 100,000 truck mechanics employed in 1970 worked for firms that own fleets of trucks. Fleet owners include trucking companies and companies that haul their own products such as dairies, bakeries, and construction companies. Other employers include truck dealers, truck manufacturers, independent truck repair shops, firms that rent or lease trucks, and Federal, State, and local governments.

Most of the estimated 17,000 bus mechanics employed in 1970 worked for local transit companies and intercity buslines. Bus manufacturers employed a relatively small number of mechanics.

Truck and bus mechanics are employed in every section of the country, but most of them work in large towns and cities where trucking companies, buslines, and other fleet owners have large repair shops.

Training, Other Qualifications, and Advancement

Most truck or bus mechanics learn their skills on the job. In shops where fleets of trucks and buses are serviced, beginners usually perform tasks such as cleaning, fueling, and lubrication. They may be required to drive vehicles in and out of the shop. As beginners gain experience and as vacancies become available, they usually are promoted to mechanics' helpers. In some shops, young persons—especially those who have prior automobile repair experience—are hired as mechanics' helpers.

Most helpers are able to make minor repairs after a few months' experience and are allowed to handle increasingly difficult jobs as they prove their ability. Generally, 3 to 4 years of on-the-job experience is necessary to qualify as an all-round truck or bus mechanic. Additional training may be necessary for mechanics who wish to specialize in diesel engines.

Most training authorities, including joint labor-management committees for the truck transportation industry, recommend a formal 4-year apprenticeship as the best way to learn these trades. Typical apprenticeship programs for truck and bus mechanics consist of approximately 8,000 hours of shop training and at least 576 hours of related classroom instruction. Frequently, these programs include training in both diesel and gasoline engine repair.

Unemployed and underemployed workers seeking entry jobs as truck mechanics are trained in a large number of cities under the Manpower Development and Training Act. This training, which lasts up to a year, stresses basic maintenance and repair work, but additional on-the-job or apprenticeship training is needed before workers can qualify as skilled mechanics.

For entry jobs, employers generally look for young men who have mechanical aptitude, and are at least 18 years of age and in good physical condition. Completion of high school is an advantage in getting an entry mechanic job because most employers believe it indicates that a young man can "finish a job" and has advancement potential.

When the mechanic's job includes driving trucks or buses on public roads, applicants may have to get a State chauffeur's license. If the employer is engaged in interstate transportation, the applicant also may be required to meet qualifications for drivers established by the U.S. Department of Transportation. He must be at least 21 years of age, able bodied, have good hearing, and have at least 20/40 eyesight with or without glasses. He must be able to read and speak English; have at least 1 year's driving experience (which may include driving private automobiles); and have a good driving record.

Young men interested in becoming truck or bus mechanics can gain valuable experience by taking high school or vocational school courses in automobile repair. Courses in science and mathematics are helpful since they give a young man a better understanding of how trucks and buses operate. Courses in diesel repair provide valuable related training. Practical experience in automobile repair gained from working in a gasoline service station, training in the Armed Forces, and working on automobiles as a hobby also is valuable.

Most employers require mechanics to purchase their own handtools. Experienced mechanics often have several hundred dollars invested in tools.

Employers sometimes send experienced mechanics to special training classes conducted by truck, bus, diesel engine, and parts manufacturers. In these classes, mechanics learn to repair the latest equipment or receive special training in subjects such as diagnosing engine malfunctions.

A young person considering a career as truck or bus mechanic should have strength and manual dexterity to handle tools and equipment. Good mechanics read many service and repair manuals to keep abreast of engineering changes. Truck and bus mechanics work independently and are able to see the results of their work.

Experienced mechanics who have supervisory ability may advance to shop foremen or service managers. Truck mechanics who have sales ability sometimes become truck salesmen. Some mechanics open their own gasoline service stations or independent repair shops.

Employment Outlook

Employment of truck mechanics is expected to increase rapidly through the 1970's as a result of significant increases in the transportation of freight by trucks. More trucks will be needed for both local and intercity hauling as a result of increased industrial activity, continued decentralization of industry, and the continued movement of the population to the suburbs. In addition to the job openings expected to occur as a result of employment growth, more than a thousand openings are expected each year from the need to replace workers who die or retire. Job openings also will occur as some mechanics transfer to other occupations.

Several hundred job openings for bus mechanics are anticipated annually through the 1970's to replace workers who retire, die, or transfer to other occupations. Total employment, however, is expected to remain at about the present level, because of offsetting factors affecting the demand for bus service. More buses will be needed for intercity travel due to increasing population, new highways, and less railroad passenger service. Local bus travel, on the other hand, is expected to decline as a result of the growing use of private automobiles in cities and suburbs.

Earnings and Working Conditions

According to a survey covering 88 metropolitan areas in 1970, mechanics employed by trucking companies, buslines, and other firms that maintain their own vehicles had average straight-time hourly earnings of $4.01. Average hourly earnings of these workers in individual cities ranged from $2.96 in Portland, Me., to $5.02 in San Francisco–Oakland, Calif.

Apprentices' wage rates generally start at 50 percent of skilled workers' rates and are increased about every 6 months until a rate of 90 percent is reached during the last 6 months of the training period.

Most mechanics work between 40 and 48 hours per week. Because many truck and bus firms provide service around the clock, mechanics may work evenings, night shifts, and weekends, for which they usually receive a higher rate of pay. A large number of employers provide holiday and vacation pay; many pay part or all of the cost of financing employee health and life insurance programs and other employee benefits. Some employers furnish laundered uniforms.

Truck mechanics and bus mechanics are subject to the usual shop hazards such as cuts and bruises. If proper safety precautions are not followed, there is danger of injury when repairing heavy parts supported on jacks and hoists. Mechanics handle greasy and dirty parts and may stand or lie in awkward or cramped positions for extended periods of time when repairing vehicles. Work areas usually are well lighted, heated, and ventilated, and many employers provide locker rooms and shower facilities. Although most work is performed indoors, mechanics occasionally make repairs outdoors where breakdowns occur.

Many truck and bus mechanics are members of labor unions. These include the International Association of Machinists and Aerospace Workers; the Amalgamated Transit Union; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the Transport Workers Union of America; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.).

Sources of Additional Information

For further information regarding work opportunities for truck or bus mechanics, inquiries should be directed to local employers such as trucking companies, truck dealers, or bus lines; locals of unions previously mentioned; or the local office of the State employment service. The State employment service also may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities. General information about the work of truck mechanics and apprenticeship training may be obtained from:

American Trucking Associations, Inc., 1616 P St. NW., Washington, D.C. 20036.

VENDING MACHINE MECHANICS

(D.O.T. 639.381)

Nature of the Work

The convenience of automatic, 24-hour merchandising and the great variety of items provided by vending machines have increased job opportunities for skilled mechanics who maintain and repair these machines. The familiar gum ball, cigarette, or other mechanical, gravity-operated dispensing device no longer typifies modern vending machines. Today, vending machines include growing numbers of complex, electrically operated machines that dispense hot canned foods and ready-to-eat dinners, and brew cups of coffee flavored to taste.

Most vending machine mechanics work both in repair shops and at locations where machines are installed, such as schools, office buildings, factories, theaters, transportation terminals, and hospitals. Some work only in repair shops; others work only in the field and travel by car or small truck from one location to another to make machine repairs.

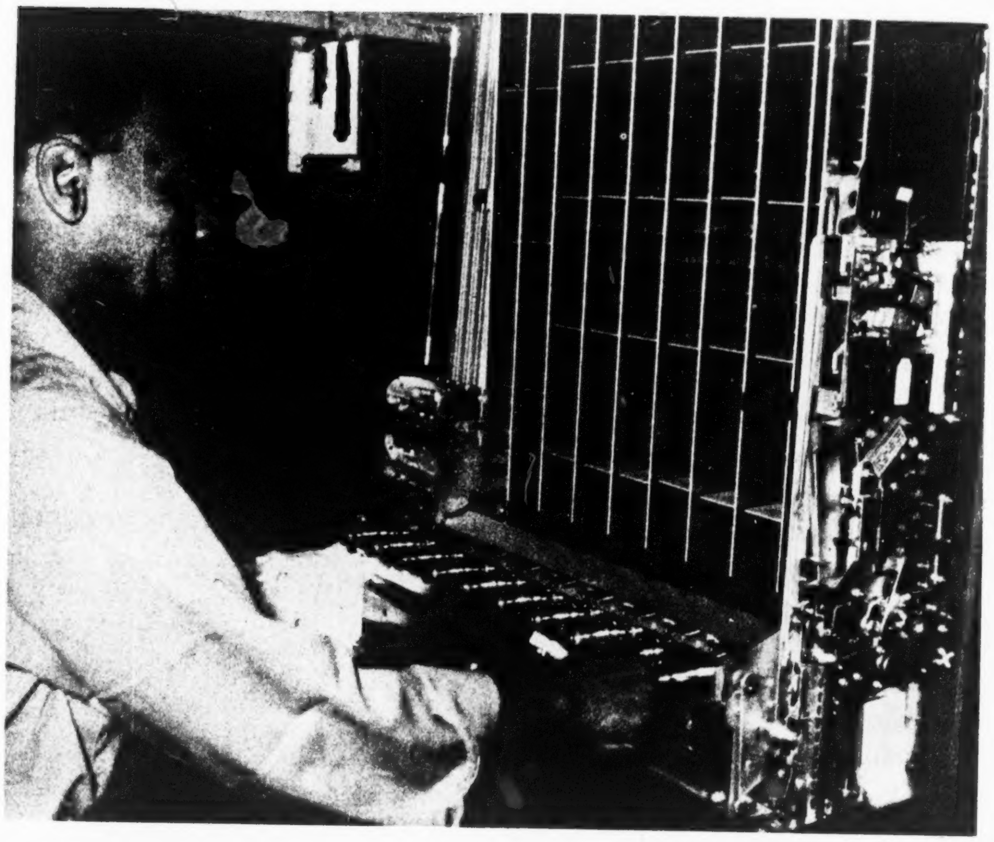
In the repair shops, mechanics repair complex vending machine components, such as water pumps, motors, and relays, and overhaul machines by replacing worn or damaged parts. They also may assemble new machines in the shop, following instructional materials supplied by the manufacturer. After the machines are assembled, they are filled with products or ingredients and test run. When working on relatively complex machines—for example, beverage dispensing machines—mechanics check to see that the machines dispense proper quantities of ingredients and that their refrigerating or heating units operate properly. On gravity-operated machines, mechanics check springs, plungers, and merchandise-delivery systems. They also test coin and change-making mechanisms. When installing a machine on location, mechanics make the necessary water and electrical connections and recheck the machines for proper operation.

When a machine on location is reported to be defective, the mechanic first determines the cause of the trouble. He inspects the machine for obvious troubles, such as loose electrical wires, malfunctions of the coin mechanism, and water and other leaks. He may test the machine's components to isolate the defective parts. After the mechanic locates the cause of the trouble, he may remove and repair or replace the defective parts, either on location or in his employer's service shop.

Preventive maintenance—avoiding trouble before it starts—is another major responsibility of the mechanic. For example, he periodically cleans electrical contact points, lubricates mechanical parts and adjusts machines to perform properly. Both in the service shop and on location, mechanics use handtools, such as wrenches, screwdrivers, hammers, pliers, pipe cutters, electrical circuit testers and soldering irons. In the service shop, they also may use power tools, such as grinding wheels, saws, and drills.

Vending machine mechanics use operating and troubleshooting manuals to repair machine systems and components. They must know how and when to do soldering or brazing to repair piping systems; how to read diagrams of electrical circuits; and how to test electrical circuits and components. Mechanics who install and repair food vending machines must know State public health and sanitation standards as well as those established under local plumbing codes. They also must know and comply with safety procedures, especially when working with electricity and gas and when lifting heavy objects.

Repairmen are required to do some clerical work. For example, they may fill out reports, prepare



repair-cost estimates, keep parts inventories, and order parts. If they are chief mechanics, they prepare work schedules for other mechanics. Mechanics employed by small operating companies frequently service as well as repair machines. These combination "repair-routemen" are responsible for periodically stocking machines, collecting money, filling coin and currency changers, and keeping daily records of merchandise distributed. (Additional information about vending machine routemen is included in the statement on routemen elsewhere in the *Handbook*. See index for page numbers.)

Places of Employment

In 1970, an estimated 18,000 mechanics maintained and repaired approximately 5 million vending machines. Vending machine repairmen work mainly for operators who place machines in selected locations and provide necessary services, such as cleaning, stocking, and repairing. Some repairmen also are employed by beverage companies which have coin operated machines on location. Although vending machine operators are located throughout the country, most mechanics are employed in the major industrial and commercial centers where large numbers of vending machines are located.

Vending machine manufacturers employ some highly skilled mechanics to explain technical innovations and ways to repair new machines to vending machine repairmen. Such instruction takes place either in manufacturers' service divisions in major metropolitan areas or in operator's repair shops.

Training, Other Qualifications, and Advancement

Young men usually enter this trade as general shop helpers. If shop helpers show promise as mechanics, they may become trainees. Some young men are hired directly as trainees.

Mechanic trainees acquire skills on the job—observing, working with, and receiving instruction from experienced mechanics. Sometimes, trainees attend manufacturer-sponsored training sessions, which emphasize the repair of new and complex machines. Employers usually pay the wages and expenses of trainees during these sessions which may last from a few days to several weeks.

Because vending machines are increasing in complexity, some operators encourage both trainees and experienced mechanics to take evening courses in subjects related to machine operation and repair—for example, basic electricity. At least part of the tuition and book expenses for these courses is paid for by the employers.

The duration of on-the-job training varies with the individual's capabilities and the extent of his prior education. Although 1½ to 2 years may be required for a trainee to become skilled in his work, within 6 to 9 months he usually can handle simple repair jobs and may be sent out alone on trouble calls. Mechanics are generally "in training" throughout their working lives, since they must constantly increase their working knowledge to handle new and improved vending equipment.

Many beginners in this trade are high school graduates, although employers generally do not require a high school diploma for employment. High school or vocational school courses in electricity and machine repair help beginners to qualify for entry jobs. These courses also may help beginners to skip the lowest rung of the job ladder—general shop helper.

Employers require prospective repairmen to demonstrate mechanical ability, either through their work experience or by scoring well on mechanical aptitude tests. The ability to deal tactfully with people is important to employers who are considering applicants. A commercial driver's license and a good driving record are essential for most vending machine repair jobs.

Skilled mechanics may be promoted to senior mechanic or, in large companies, to shop foreman or supervisor. Advancement to service manager, who schedules repair work, is possible for a few mechanics having administrative ability. A few mechanics having initiative and adequate financial backing become independent operators.

Employment Outlook

Employment of vending machine mechanics is expected to increase moderately through the 1970's. In addition to new jobs created by growth, a few hundred jobs will become available each year because of the need to replace repairmen who retire, die, or transfer to other fields of work.

Some of the factors that stimulated past growth and increased the demand for the services of qualified mechanics are the introduction of new and improved machines that dispense a growing variety of merchandise; convenient, round-the-clock service; and the rising costs of selling low-priced, standard items through conventional procedures. Improvements in currency-changing devices also have stimulated the growth of the industry by making it more convenient for customers to use vending machines.

Other factors that will continue to contribute to the industry's growth include an expanding population; rising levels of personal income; movement of industrial plants, schools, hospitals, department stores, and other establishments to the suburbs where restaurants are often inconveniently located; and the rising popularity of light meals and snacks.

Earnings and Working Conditions

Wage data for vending machine mechanics are available from a number of union-management contracts in effect in early 1970 covering workers employed by vending machine companies in 14 States and the District of Columbia. Although these contracts show a very wide range of straight-time hourly pay rates for mechanics, the majority provided for hourly rates ranging between $3.20 and $4.25. Different hourly rates for shop mechanics and for field (street) mechanics were stipulated in several contracts. In a few, mechanics' rates differed, depending on the complexity of the machines being repaired.

Most vending machine repairmen work 8 hours, 5 days a week, and receive premium pay for over-time work. Since vending machines can be operated 24 hours a day, mechanics frequently are required to work at night and on weekends and holidays. Some union-management contracts stipulate higher rates of pay for nightwork and for emergency repair work on weekends and holidays.

Many union-management agreements covering vending machine mechanics include health insurance provisions for hospital, medical, and surgical benefits, usually financed by the employer. Some contracts provide for employer-financed retirement benefits. Vacation and holiday pay provisions are commonly included. Paid vacations are granted according to length of service—usually, 1 week after 1 year of service, 2 weeks after 2 years, and 3 weeks after 10 years. The majority of contracts provide for 7 or 8 paid holidays annually.

Vending machine repair shops are generally quiet, well-lighted, and have adequate work space. However, when working on machines on location, mechanics may work in cramped quarters, such as passageways, where pedestrian traffic is heavy. Repair work is relatively safe, although mechanics are subject to shop hazards such as electrical shocks and cuts from sharp tools and metal objects.

Many vending machine mechanics employed by large companies are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen, and Helpers of America.

Sources of Additional Information

Further information about work opportunities in this trade can be obtained from local vending machine operators and local offices of the State employment service. Additional information about employment in this field is available from the National Automatic Merchandising Association, 7 South Dearborn St., Chicago, Ill. 60603.

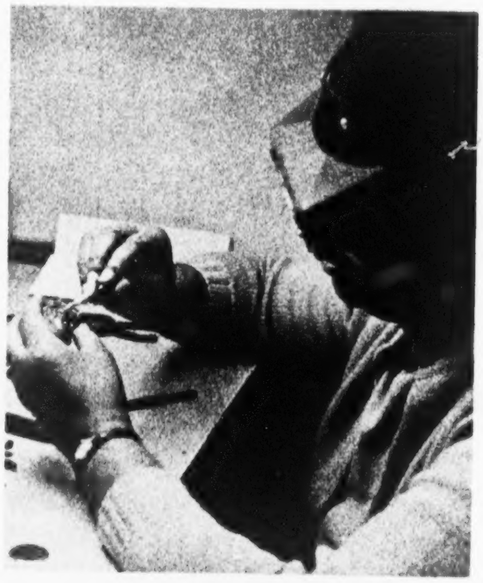
WATCH REPAIRMEN

(D.O.T. 715.281)

Nature of the Work

Watch repairmen (also called watchmakers) are skilled craftsmen who clean, repair, and adjust watches, clocks, chronometers, and other time pieces. When a watch is not operating properly, the repairman uses tweezers, screwdrivers, and other tools to remove the watch from its case and disassemble the movement. With the aid of a loupe (magnifying glass), he examines carefully various parts of the mechanism to determine necessary repairs and replacements.

Depending on the reason for the malfunction, he may replace the mainspring, hairspring, balance and other wheels, stems and crowns, hands or broken jewels, and adjust improperly fitted wheels and other parts. The parts are cleaned and oiled before the watch is reassembled and tested for accuracy.



The development of interchangeable mass-produced watch parts has decreased the watch repairman's need to make parts by hand. However, he frequently must adjust factory-made parts for complicated timepieces to insure a "true" fit.

Watch repairmen use timing machines; cleaning machines, including ultrasonic cleaners; and handtools, such as tiny pliers, tweezers, and screwdrivers. The repair of electric and electromechanical watches and clocks requires the use of electrical meters.

Watch repairmen are frequently proprietors of jewelry stores, and may do minor jewelry repair and sell watches, jewelry, silverware and other items. They also may hire and supervise salesclerks, other watch repairmen, jewelers, and engravers; arrange window displays; purchase goods to be sold; and handle other managerial duties.

Places of Employment

About 15,000 watch repairmen were employed in 1970, about half of whom were self-employed. Most self-employed watch repairmen owned small retail jewelry stores that perform repair work on the premises. Others operated their own repair shops and specialized in repairing watches for jewelry stores. Most of those who were not self-employed worked in retail jewelry stores and the remainder worked in repair shops, wholesale establishments, and plants that manufacture watches, clocks, or other precision timing instruments. A few watch repairmen were instructors in vocational schools.

A substantial number of individuals who received training as watch repairmen used their skill in jobs such as instrument maker, repairman, or assembler; laboratory technician; and microminiaturization specialist.

Although scattered throughout the country, retail jewelry stores and repair shops are concentrated in large commercial centers such as New York City, Chicago, Los Angeles, Philadelphia, and San Francisco.

Training, Other Qualifications, and Advancement

Many young people prepare for this trade through courses given in private watch repair schools, public vocational high schools, or post-high school training. Others are trained through formal apprenticeship or other on-the-job training programs. Training in instrument repair work in the armed services can be helpful to those who wish to become watch repairmen.

There generally are no specific educational requirements for entrance into any of the approximately 40 watch repair schools, although most students are high school graduates. The length of time required to complete the course—usually 18 months—is determined by its content, the ability of the individual student, and whether attendance is full or part time. In most watch repair schools, a considerable amount of time is spent taking apart and reassembling various kinds of watch movements, truing hairsprings, removing and replacing balance staffs, fitting friction jewels, and learning how to use a watchmaker's lathe and watch cleaning machines. Some schools offer courses in the repair of unusual types of timepieces, such as chronographs, calendars, and timers. Most schools require students to furnish their own handtools.

Students or watch repairmen interested in employment outside of jewelry stores or repair shops may require training in related subjects such as basic electronics, instrument repair or microminiaturization technology which is provided on the job in many industries.

The following States require watch repairmen to obtain a license: Florida, Indiana, Iowa, Kentucky, Louisiana, Michigan, Minnesota, North Carolina, North Dakota, Oregon, and Wisconsin. To obtain a license, they must pass an examination designed to test their skill with tools and their knowledge of watch construction and repair.

Watch repairmen in all States, however, can demonstrate their degree of competence by passing one of two certification examinations given by the American Watchmakers Institute. Successful examinees receive the title of either Certified Watchmaker or Certified Master Watchmaker, depending on their proficiency. Annual voluntary upgrading examinations covering some new phase of watchmaking also are offered to those watch repairmen who desire to prove their ability to keep up with the times. Those who pass the up-grading examination receive a plaque of recognition.

Beginners who have sufficient funds may open their own watch repair shops. The usual practice, however, is to work for an experienced watch repairman before starting one's own business. Some owners of watch repair shops sell various items of jewelry, and may eventually establish retail jewelry stores. These stores require a more substantial financial investment.

A young person planning a career as a watch repairman must be willing to sit for long periods and work by himself with a minimum of supervision. The precise and delicate nature of the work requires patience and concentration. Good visual depth perception helps in working with tiny parts. Watch repair is "problem-solving" work because the repairman must find and eliminate malfunctions.

Employment Outlook

Employment of watch repairmen is expected to show little or no change through the 1970's. However, hundreds of job openings will arise annually from the need to replace experienced workers who retire, die, or transfer to other fields of work. Opportunities will be particularly favorable for highly skilled watch repairmen because the number being trained is insufficient to meet current needs.

The number of watches and clocks in use will grow fairly rapidly due to rising population and incomes. The trends toward owning more than one watch, wearing watches as costume jewelry, and buying more children's watches are expected to continue. Only a limited number of these watches will be repaired, however, because most will be pin-lever watches which cost little more to replace than to repair. Consequently, the demand for watch repairmen is not expected to keep pace with increases in the number of watches in use.

New openings for watch repairmen will occur in retail stores and repair shops in small cities where business is expanding and in newly established suburban shopping centers. In addition, demand will continue for well-trained workers to use their watch repair skills in the production of miniaturized devices, especially in industries making scientific instruments and electronic equipment.

Earnings and Working Conditions

Earnings of watch repairmen in entry jobs generally ranged from about $90 to $120 a week in 1970 and depended on individual ability and place of employment. Experienced watch repairmen employed in retail stores, repair shops, and watch manufacturing establishments received from $120 to $200 for a 40-hour week. In addition, repairmen in retail stores may receive commissions based on sales of watches and other items in the store. Repairmen in large retail and manufacturing establishments often participate in life and health insurance programs and savings and investment plans. Watch repairmen who are in business for themselves usually earn considerably more than those working for a salary. Earnings of the self-employed depend on the amount of repair work done and, in the case of watch repairmen who own retail jewelry stores, the volume of sales and working hours.

Watch repairmen frequently work longer than the standard 40-hour week. Those who are self-employed or located in small communities usually work a 48-hour week or longer. The work involves little physical exertion and generally is performed in comfortable, well-lighted surroundings. This light, sedentary work frequently is recommended to certain handicapped workers.

Some watch repairmen are members of the International Jewelry Workers Union or the America Watch Workers Union (Ind.).

Sources of Additional Information

Information on training courses, as well as on watch repairing as a career, may be obtained from:

American Watchmakers Institute,
P.O. Box 11011, Cincinnati, Ohio
45211.

Information on watch repair job opportunities in retail stores can be obtained from:

Retail Jewelers of America, Inc.,
1025 Vermont Ave., NW., Washington, D.C. 20005.

Further information about work opportunities or training in this trade may be available from local offices of the State employment service.

PRINTING (GRAPHIC ARTS) OCCUPATIONS

Printing is an art, a leading industry, and one of our chief means of communication. In 1970, it provided employment for more than 1 million workers in a wide variety of occupations. Although these occupations are found principally in the printing, publishing, and allied industries, they also are found in government agencies and in private firms that do their own printing, such as banks and insurance companies. About one-third of all printing employees work in printing craft occupations. These craft occupations are described in detail later in this chapter. Other occupations in the printing industries include printing estimator, printing technician, mailer, computer programer, and computer typist, as well as the usual administrative, clerical, maintenance, and sales occupations found in all industries.

Nature and Location of the Industry

The printing process is basically a means of transferring ink impressions of words, numerals, symbols, and photographs or other illustrations to paper, metal, or other materials. The most commonly used methods of printing are letterpress, lithography, gravure, flexography, and screen printing. Each method has special advantages and requires some special skills.

Included in the printing, publishing, and allied industries are the printing and publishing of newspapers, magazines, books, and advertising matter; the production of business forms; the production of greeting cards and gift wrappings; commercial or job printing; bookbinding; and the provision of typesetting, photo-engraving, platemaking, and other printing services, primarily for printing establishments.

In 1970, the largest division in terms of employment was newspaper printing and publishing, with over 370,000 employees in approximately 8,000 establishments. Most daily and many weekly newspapers throughout the Nation do their own printing. Although some major newspapers have more than 2,000 employees, many smaller dailies and weeklies have fewer than 20 employees.

Commercial or job printing establishments, the second largest division, employed about 355,000 workers in approximately 19,000 establishments. Establishments in this division produce a great variety of materials, including advertising matter, letterheads, business cards, calendars, catalogs, labels, maps, and pamphlets. They also print limited-run newspapers, books, and magazines. More than half of all workers in commercial shops are in establishments having fewer than 100 employees. Many establishments, however, have several hundred employees.

Printing jobs are found throughout the country. Almost every town has at least one printing shop of some kind—frequently, a small newspaper plant which also may do other printing. However, more than half of the nation's printing employees are in five States—New York, Illinois, California, Pennsylvania, and Ohio. Within these States, most printing activities are in or near manufacturing, commercial, or financial areas such as New York, Chicago, Los Angeles, Philadelphia, San Francisco–Oakland, Cincinnati, and Cleveland. Other leading centers of printing employment are Boston, Detroit, Minneapolis–St. Paul, Washington, D.C., St. Louis, and Baltimore. Employment in book and magazine printing is highly concentrated in these areas. A much larger proportion of employment in newspaper plants, however, is found outside these centers because of the great number of small local newspapers.

Printing Methods

All methods of printing have certain common characteristics. A surface of metal, stone, wood, linoleum, rubber, or plastic is prepared so that part of it can be covered with ink. The ink is then transferred to a sheet of paper or other material which is pressed against the prepared surface.

In relief printing, the printing surface stands up from the rest of the surrounding printing plate area. Ink is rolled over the raised surface and then paper is pressed against it. The best known and most widely used example of this method is letterpress printing. Other examples of relief printing are flexography, in which a flexible rubber plate and rapid drying fluid inks are used; linoleum and wood block printing; and relief engraving on metal or plastic.

Flexography is widely used for printing on plastic films and foil bags, milk containers, gummed tape, and bread and candy wrappers. In lithography (offset printing), the printing plate surface is smooth, with both image and nonimage areas on the same level. Lithography is based on the principle that grease and water do not mix. The image areas of the plate are coated with a substance to which the greasy printing ink will adhere. On the press, the plate is moistened with water before each inking so that only the image areas take up the greasy ink from the inking roller. The inked image is transferred from the plate to a rubber blanket and then offset to the surface to be printed. The lithographic method can be used to produce practically all items printed by any other method. It is especially satisfactory for printing on rough-textured surfaces because of the flexibility of the rubber blanket.

In gravure printing, the image to be reproduced is etched into the surface of the printing plate. The whole surface is covered with ink and then wiped off; ink is left only in the sunken or etched areas. When paper or other material is firmly pressed against the surface, the ink is lifted out and appears on the paper. Copper and steel plate engraving also uses this technique.

Screen printing is a method in which inks or other materials such as paint, varnish, and liquid plastic are forced by the action of a flexible blade through a stencil mounted on a finely woven screen, generally plastic or stainless steel. The shape of the stencil openings determines the design to be printed. This process may be applied to a wide variety of surfaces such as conventional paper, cardboard, wood, glass, metal, plastic, and textiles. Screen printing is used on irregular surfaces and cylindrical surfaces as well as on flat surfaces.

Regardless of the method used, several basic steps are involved in the production of printed matter. They include layout—planning the composition and content of each page; typesetting and composition—producing and assembling the text type, headings, illustrations, and other materials into final page form; platemaking—preparing printing plates from the original composition for use on the printing presses; printing—transferring an image to a printing surface; and finishing—binding and mailing operations.

Printing Occupations

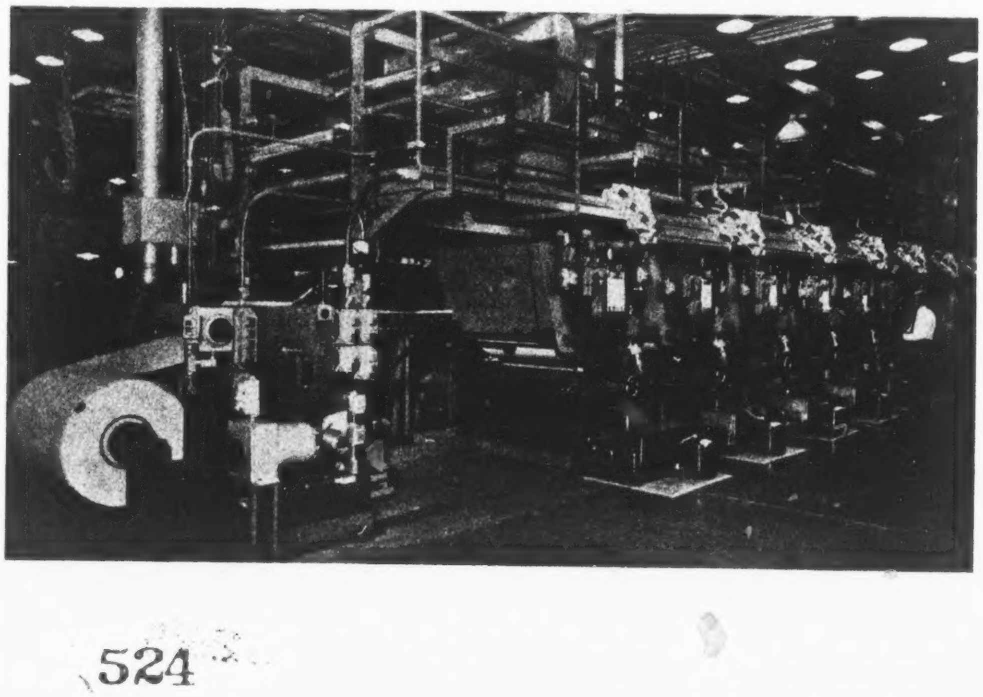
Production of printed materials involves workers in a wide variety of occupations. Printing craftsmen who in 1970 numbered over 400,000 represent a large segment of these employees. Printing craftsmen usually specialize in one area of printing operations; for example, type composition, photography, platemaking, presswork, or binding. Their training, moreover, is confined largely to only one of the basic printing methods—letterpress, lithography, or gravure.

The estimated 185,000 skilled composing room workers employed in 1970 were the largest group of printing craftsmen. This group includes hand compositors, typesetting machine operators, makeup men, tape-perforating machine operators (teletypesetters), and proofreaders. Other large groups of skilled workers are printing pressmen and their assistants; and lithographic craftsmen, including cameramen, artists, strippers, platemakers, and lithographic pressmen. Bookbinders, photoengravers, electrotypers, and stereotypers are other important printing craftsmen. Individual occupations are described in detail in this chapter.

Maintenance machinists, who repair and adjust typesetting machines, printing presses, or bindery equipment, are another group of skilled workers employed in large plants.

In the skilled occupations, practically all the workers are men. However, many of the less skilled jobs, especially in the binderies, are held by women. Printing establishments also employ a great many persons as executives, salesmen, accountants, engineers, stenographers, clerks, and laborers. Newspapers and other publishers employ a considerable number of reporters and editors. These occupations are discussed elsewhere in the *Handbook*. (See index for page numbers.)

Because of the increasingly complex and highly mechanized printing equipment in use today, the need is growing for technically trained peo-



ple in all areas of printing management and production. For example, an increasing number of production technicians are being employed throughout the printing industry. These men are responsible for seeing that the standards established for each printing job are met. To do this, they must be thoroughly familiar with the printing processes, and the many technical instruments used in the plant to judge and control the quality of the printing.

The mailroom, chiefly in newspaper and periodical plants, is another area of employment closely related to printing production. Here workers address, bundle, and tie the printed matter for distribution. Modern mailroom processes are mechanized to a considerable extent. Mailers operate addressing, stamping, stacking, bundling, and tying machines.

Training and Other Qualifications

Apprenticeship is a common method of entry into the printing crafts. In some instances, it is the only means by which one may be trained to become a journeyman (skilled worker) in a unionized shop. Formal apprenticeship also is required for journeyman status in many larger establishments not covered by union contracts.

At the beginning of 1970, about 13,800 registered apprentices were in training in the skilled printing crafts. A registered apprentice is an employee who, under an expressed or an implied agreement, receives instruction in an apprenticeable occupation for a stipulated term and is employed in an apprenticeship program registered with a State apprenticeship agency or the U.S. Department of Labor's Bureau of Apprenticeship and Training. In addition, several thousand apprentices were in nonregistered programs. A substantial number of persons also were learning a printing trade while working as helpers, particularly in small printing shops or lettershops, or through a combination of work experience and schooling.

Printing trades apprenticeships usually last from 4 to 6 years, depending on the occupation and the shop or area practices. The apprenticeship program covers all phases of the particular trade and generally includes classroom or correspondence study in related technical subjects in addition to training on the job. As new printing methods have been developed and introduced, they generally have been incorporated into the duties of the traditional printing crafts and included in the apprentice training programs. Apprenticeship applicants generally are required to be between 18 and 30 years of age and must pass a physical examination. However, in many printing crafts, there is no maximum age limit for entry into an apprenticeship.

In selecting applicants for printing craft jobs, most employers require a high school education or its equivalent. A thorough knowledge of spelling, punctuation, the fundamentals of grammar, and basic mathematics is essential in many of the printing trades. A knowledge of the basic principles of chemistry, electronics, and physics is becoming increasingly important because of the growing use of photomechanical and electronic processes in printing. An artistic sense is also an asset since the finished product should be pleasing in balance and design. Most printing crafts require persons with good eyesight, about average physical strength, and a high degree of manual dexterity. Mental alertness, speed combined with accuracy, neatness, patience, and the ability to work with others are also necessary. The ability to distinguish colors is important in areas of printing where color is used. Many employers require applicants to take one or more aptitude tests developed for printing industry occupations by the U.S. Department of Labor. These tests are given in the local offices of State employment services. Apprentices often are chosen from among the young men already employed in various unskilled jobs in printing establishments who demonstrate the mechanical aptitudes essential for the printing crafts.

About 4,000 schools—high schools, vocational schools, technical institutes, and colleges—offer courses in printing. These courses may help a young person to be selected for apprenticeships or other job openings in the printing and publishing industries.

Employment Outlook

Opportunities to enter the skilled printing trades through the 1970's will be many and will result primarily from the need to replace experienced workers who retire, die, or transfer to other fields of work.

Slight employment increases in some printing trades also are expected to provide a small number of additional job openings annually. Many of the opportunities will be in new types of jobs because of technological changes in production methods.

A continued rise in the volume of printed material is expected because of population growth, the increasingly high level of education, the expansion of American industry, and the trend toward greater use of printed materials for information, packaging, advertising, and various industrial and commercial purposes. However, employment in skilled printing trades is not expected to increase significantly because of the continuing introduction of laborsaving technological changes in printing methods. These changes, primarily in the areas of type composition, platemaking, and bindery operations, include the increasing use of electronic devices such as computers, electronic etching and color-separating equipment, and electronic controls for highly mechanized bindery equipment.

Employment growth will vary among the printing trades. For example, employment of compositors, the largest group of printing craftsmen, is expected to decrease slightly despite the continued increase in the volume of printing because of laborsaving technological changes in typesetting and composition. Employment of lithographic craftsmen, however, is expected to increase because of the growing use of lithography (offset printing).

Earnings and Working Conditions

Earnings of production workers in the printing and publishing industry, including the unskilled and semiskilled workers and printing craftsmen, are among the highest in manufacturing industries. In 1970, production workers in the industry averaged $147.78 for 37.7 hours a week, or $3.92 an hour. In comparison, production workers in manufacturing industries as a whole average $133.73 for 39.8 hours a week, or $3.36 an hour.

Earnings of individual printing craftsmen vary from one occupation to another. Generally, the wage rates in large cities are higher than in small communities. Wage rates also differ by type of printing establishments. The following tabulation shows the average union minimum hourly wage rates for daywork for selected printing occupations in 69 large cities on July 1, 1970. These rates are the minimum basic rates for the individual occupational classifications. They do not include overtime, other special payments, or bonuses.

Average union hourly rate July 1, 1970[1]

	News-paper	*Book and job*
Bookbinders	...	$4.89
Compositors:		
Hand	$5.00	5.14
Machine operators	5.09	5.09
Electrotypers	...	4.91
Photoengravers	5.56	...
Pressmen (journeymen)	4.94	...
Pressmen (cylinder)	...	5.00
Pressmen (platen)	...	4.46
Stereotypers	4.87	5.23
Mailers	4.61	4.11

[1] Average day rates.

Most printing trades workers who are covered by union-management contracts work fewer than 40 hours a week. Some contracts specify a standard workweek of less than 35 hours, but most fall within a 35 to 37½ hour range. Time and a half generally is paid for overtime. Work on Sundays and holidays is paid for at time and one-half or doubletime rates in most commercial printing establishments. In newspaper plants, however, the craftsmen's workweek often includes Sundays. Time and one-half or double time is paid for these days only when they are not part of the employee's regular shift. Night-shift workers generally receive pay differentials above the standard day rates.

The starting wage rates of apprentices are generally from 40 to 50 percent of the basic rate for journeymen in the shop. Wages are increased periodically, usually every 6 months, until in the final year or half year of training, the apprentice receives from 80 to 95 percent of the journeyman rate. Apprentices who have prior civilian or military experience sometimes can obtain credit which will start them above the beginning apprentice pay rate, and also reduce the length of time required to become a journeyman if they successfully pass examinations provided for situations of this nature. In exceptional cases, these provisions also apply to apprentices with technical school training. In some of the trades, apprentices may be upgraded when they show exceptional progress.

Paid vacations generally are provided for printing craftsmen. The most common provision in labor-management agreements is 2 weeks' vacation after 1 year's employment. Many agreements, however, provide for 3 weeks' vacation after 1 year or more of employment, and an increasing number provide for 4 weeks after 20 or 25 years. Other major benefits, such as paid holidays, retirement pay, life and disability insurance, hospitalization, and severance pay, are also common. In addition, a number of printing trade unions have for many years operated their own programs providing their members with one type of benefit or more, such as life insurance, retirement, sickness, or disability payments.

The injury-frequency rate in the printing industry is somewhat lower than the average for all manufacturing industries.

A large proportion of the printing trades workers are members of unions affiliated with the AFL-CIO. The largest printing trades unions are the International Printing Pressmen and Assistants' Union of North America; the International Typographical Union; and the Lithographers and Photoengravers Union. Other printing trades unions include the International Brotherhood of Bookbinders; the International Stereotypers' and Electrotypers' Union of North America; and the International Mailers Union (Ind.). Most unionized lithographic workers are in plants under contract with the Lithographers and Photoengravers International Union, which includes both printing craftsmen and other lithographic workers.

Sources of Additional Information

Information on opportunities for apprenticeship or other types of printing employment in a particular locality may be obtained from various sources. Applicants may apply directly to the printing establishments in their areas. The names and locations of local printers usually can be obtained from the classified section of the telephone directory. In addition, the local unions and employer associations in the printing industry often can provide information regarding apprenticeship openings. In recent years, increasing use has been made of local offices of the State employment services as information exchanges for apprenticeship openings. Some of these offices provide service such as screening applicants and giving aptitude tests.

General information on the printing industry may be obtained by writing to the following organizations:

American Newspaper Publishers Association, 750 Third Ave., New York, N.Y. 10017.

Education Council of The Graphic Arts Industry, Inc., 4615 Forbes Ave., Pittsburgh, Pa. 15213.

Graphic Arts Technical Foundation, 4615 Forbes Ave., Pittsburgh, Pa. 15213.

Gravure Technical Institute, 60 East 42d St., New York, N.Y. 10020.

International Typographical Union, P.O. Box 157, Colorado Springs, Colo. 80901.

Printing Industries of America, Inc., 1730 North Lynn St., Arlington, Va. 22209.

(See sections on individual printing occupations for names of labor organizations and trade associations which can provide more information on specific printing trades.)

COMPOSING ROOM OCCUPATIONS

(D.O.T. 650.582, 654.782, and 973.381)

The printing process begins in a composing room where manuscript copy is set in type, proofed, and checked for errors. Machine and handset type, and other materials, such as photoengravings, are assembled there and prepared for the pressroom.

In 1970, nearly half of all printing craftsmen—about 185,000—were employed in composing room occupations. These occupations offer many opportunities for persons interested in learning a skilled craft. Composing room workers include compositors who set type by hand; typesetting machine operators who operate semiautomatic typesetting machines; tape-perforating machine operators who perforate tapes used to operate some typesetting machines; *bankmen* who assemble type in shallow trays called "galleys" and make trial proofs of this type; *proofreaders* who check the galley proofs with the original copy for errors; *make-up men* who assemble type and photoengravings in page forms; and *stonehands,* who arrange the pages in proper sequence.

Compositors are employed in newspaper plants, commercial printing shops, book and periodical printing plants, and typographic composition firms that set type for printing establishments, advertising agencies, and advertising departments of large business firms. One-third of all compositors work in newspaper plants. A large number are employed in establishments that specialize in setting type for book and magazine publishers.

Skilled composing room workers are employed in almost every community throughout the country, but they are concentrated in large metropolitan areas.

Nature of the Work

Hand compositors (typesetters) (D.O.T. 973.381) make up the oldest composing room occupation. Today most type that is set by hand is for work requiring very fine composition (usually larger size type for advertising copy) and for small jobs in which the setting of type by machine would be impractical.

In setting type by hand, the compositor, reading from the manuscript copy, first sets each line of type in a "composing stick" (a device which holds type in place) letter by letter and line by line. When this stick is full, he slides the completed lines onto a shallow metal tray called a "galley."

Typesetting machine operators are craftsmen who operate semi-automatic machines which set type much more rapidly than the hand compositors. The type size used in machine set composition ordinarily is much smaller than that set by hand.

Linotype (*or Intertype*) *machine operators* (D.O.T. 650.582) reading from the copy clipped to the machine's copy board, select letters and other characters by operating a keyboard which has 90 keys. As they press the keys, the letters, in forms of metal molds called matrices, are assembled into lines of words. A spaceband key provides the necessary spacing between words. As they complete each line, the operators touch a lever and the machine automatically casts the line of type into a solid metal strip called a "slug." The slugs are then deposited in a galley and are later assembled into the type forms from which either the printing impressions or the plates are made. Nearly all newspaper plants, large commercial shops, and typographic composition firms use these machines and operators to set type. In the smaller plants, the typesetting machine operator maintains and repairs as well as operates the typesetting machine. In the larger plants, maintenance machinists are employed to make all but minor adjustments to the machines. In smaller plants, the typesetting machine operator maintains, repairs, and operates the typesetting machine. In large plants, maintenance machinists make all but minor adjustments to machines.

Monotype keyboard operators (D.O.T. 650.582) operate keyboards which are similar to a typewriter but have about four times as many keys. The keyboard machine produces a perforated paper tape which later is fed into the casting machine. The keyboard operator must be able to handle complicated copy, such as statistical tables.

Monotype caster operators (D.O.T. 654.782) operate casting machines which automatically cast and assemble type which is guided by perforations in the paper tape prepared by the keyboard machine. As the tape is fed into the machine, the proper matrices for casting letters

are selected automatically by perforations. Molten metal is forced into the matrix to form the individual character. As the name suggests, the monotype casting machine forms one letter at a time. Corrections may be made by hand without resetting the entire line. Caster operators insert the tape, adjust and tend the machine while it is operating, and do necessary maintenance and repair work.

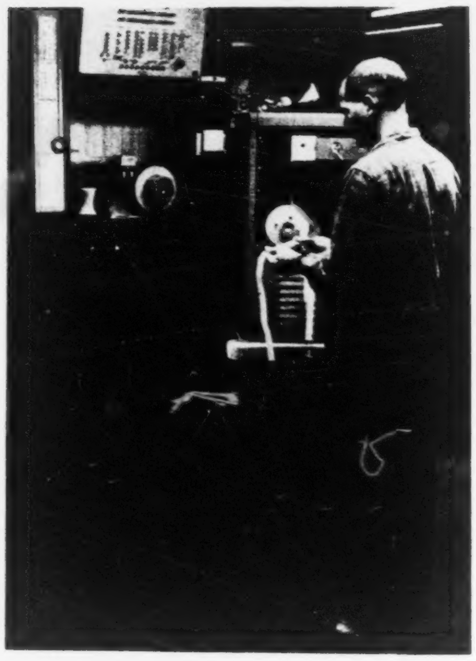
Phototypesetting machine operators (D.O.T. 650.582) set type on machines which may be similar in appearance or method of operation, or both, to those which cast type in hot metal. In phototypesetting, however, a photographic process replaces the function of the hot metal, and the final product is a film or photographic paper print of the type rather than a metal slug. In one type of machine, as the operator presses the keys, the individual matrices or mats, which contain small film negatives, are assembled and photographed character by character on film to form a line of type. In other phototypesetting machines, a perforated paper tape or a magnetic sound tape is fed into a phototypesetting machine which "reads" the tapes and photographs the individual characters indicated on the tape.

Some typesetters operate photolettering machines which produce lines or individual characters in large-size type such as those used for newspaper headlines and for advertisements. As in phototypesetting, a photographic process is involved, and the final product is on film or paper.

In addition to machine operation, the phototypesetter must be familiar with the fundamentals of photography, including darkroom procedures, to develop the film on which the type has been photographed. He also may assemble and arrange developed film into pages. This process, called "stripping," corresponds to page makeup in the hot metal type process. The operator also makes minor repairs on the phototypesetting machine. Since much of this equipment has electronic controls, the operator needs a basic working knowledge of the principles of electronics.

Typesetting machine operators also use machines similar to typewriters to set "cold type" on paper. These machines automatically space letters and lines. "Cold type" composition may be set directly on a paper or even a metal sheet from which the plate is to be made, or the cold type images may be cut from paper and pasted on layout sheets. The process of assembling and pasting this type on layout sheets is called paste makeup, and is somewhat similar to hand composition. The worker who asembles and pastes up all the materials for a page is called a *paste-makeup man*. Cold type composition frequently is used by newspapers for display advertising, and by small newspapers to set regular text copy.

Typesetters frequently operate tape-perforating machines called teletypesetters which have keyboards similar to those of typewriters. The machines are fitted with reels of tape that are perforated as the keys are struck. The perforated tapes are inserted in line casting machines, which set the type as directed by the perforations. After the tape has been punched, it may be sent by teletype to other cities where it is automatically reperforated and used to control the operation of linecasting machines.



Phototype setter sends perforated tape into phototypesetting machine.

Training and Other Qualifications

Most compositors acquire their skills through apprenticeship training. In union shops, apprentices often are selected from among the helpers. Some compositors acquire their skills while working as helpers for several years (particularly in small shops and in the smaller communities) or through a combination of trade school and helper experience.

Tape-perforating machine operators must be expert typists. They generally acquire their typing skill in commercial courses in high school or in business school. These operators do not need to be trained as journeymen compositors but they must be familiar with printing terms and measurements. The training period for tape-perforating machine operators is about a year. Journeymen compositors sometimes transfer to this occupation.

Generally, apprenticeship covers a 6-year period of progressively advanced training, supplemented by classroom instruction or correspondence courses. However, this period may be shortened by as much as 2 to 2½ years for apprentices who have had previous experience or schooling or who show the ability to learn the trade more rapidly. The time and emphasis spent on any particular phase of training depend upon the type of printing establishment and vary from plant to plant.

A typical apprenticeship program for compositors includes instruction in elementary hand composition, page makeup, lockup, lineup, and proofreading. After basic training as a hand compositor, the apprentice receives intensive training in one specialized field or more, such as the operation of typesetting machines, including phototypesetting and teletypesetting machines, as well as specialized work in hand composition and photocomposition.

Applicants for apprenticeship generally must be high school graduates and in good physical condition. They sometimes are given aptitude tests. Important qualifications include training in English, especially spelling, and in mathematics. Printing and typing courses in vocational or high schools are good preparation for apprenticeship applicants, and a general interest in electronics and photography is becoming increasingly useful. Artistic ability is an asset for a compositor in layout work.

Apprentices are paid according to a predetermined wage scale, which increases as the apprenticeship period advances. At the beginning of 1970, nearly 4,300 registered apprentices were in training for skilled composing room jobs.

Employment Outlook

A few thousand job openings for composing room workers are expected annually through the 1970's to replace experienced workers who retire, die, or transfer to other occupations.

In spite of the anticipated expansion in the volume of printing in the United States during the 1970's, employment of compositors is expected to decline slowly because of technological changes in typesetting equipment that will make it possible to set type faster using fewer operators. For example, over the past decade automatically operated typesetting machines have been used increasingly. These machines, which set lines of type in metal or on film, are activated by an electronic device into which perforated tapes are fed. The perforations indicate characters, words, sentences, length of lines, spacing, and hyphenation. The use of computers, programed to perforate the codes for spacing, length of line, and hyphenation, simplifies the work of the tape-perforating machine operator and increases the speed at which type can be set. The number of firms using computers for typesetting rose from fewer than 100 in 1964 to nearly 1,100 in 1969, and further increases are anticipated.

Technological changes also will affect significantly the educational and skill requirements for composing room workers. For example, greater use of phototypesetting requires compositors who have some photographic skills. Since much of the new typesetting equipment is operated by electronics systems a knowledge of the principles of electronics is becoming increasingly important for the compositor.

Earnings and Working Conditions

As for most printing crafts, wages of skilled composing room workers are relatively high compared with skilled workers generally. However, wage rates vary from place to place and from firm to firm. The average union minimum hourly wage rate for hand compositors on the day shift in 69 large cities was $5 in newspaper plants and $5.14 in book and job shops on July 1, 1970. Union minimum wage rates for compositors in book and job shops ranged from $3.20 an hour in Tampa, Fla., to $5.97 in Chicago, Ill. In newspaper establishments, the union minimum hourly wage rates for dayshift compositors ranged from $3.94 an hour in Little Rock, Ark., to $6.12 in New York, N.Y.

Working conditions for compositors vary from plant to plant. Some heat and noise are made by hot metal typesetting machines. In general, the newer plants are well lighted and clean, and many are air conditioned. Composing room jobs require about average physical strength. Hand compositors are required to stand for long periods of time and to do some lifting. Young men with some types of physical handicaps, such as deafness, have been able to enter the trade and do the work satisfactorily. Many compositors work at night on the second or third shift for which they generally receive additional pay.

A substantial proportion of compositors are members of the International Typographical Union.

Sources of Additional Information

International Typographical Union, P.O. Box 157, Colorado Springs, Colo. 80901.

International Typographic Composition Association, Inc., 2233 Wisconsin Ave. NW., Washington, D.C. 20007.

Printing Industries of America, Inc.,

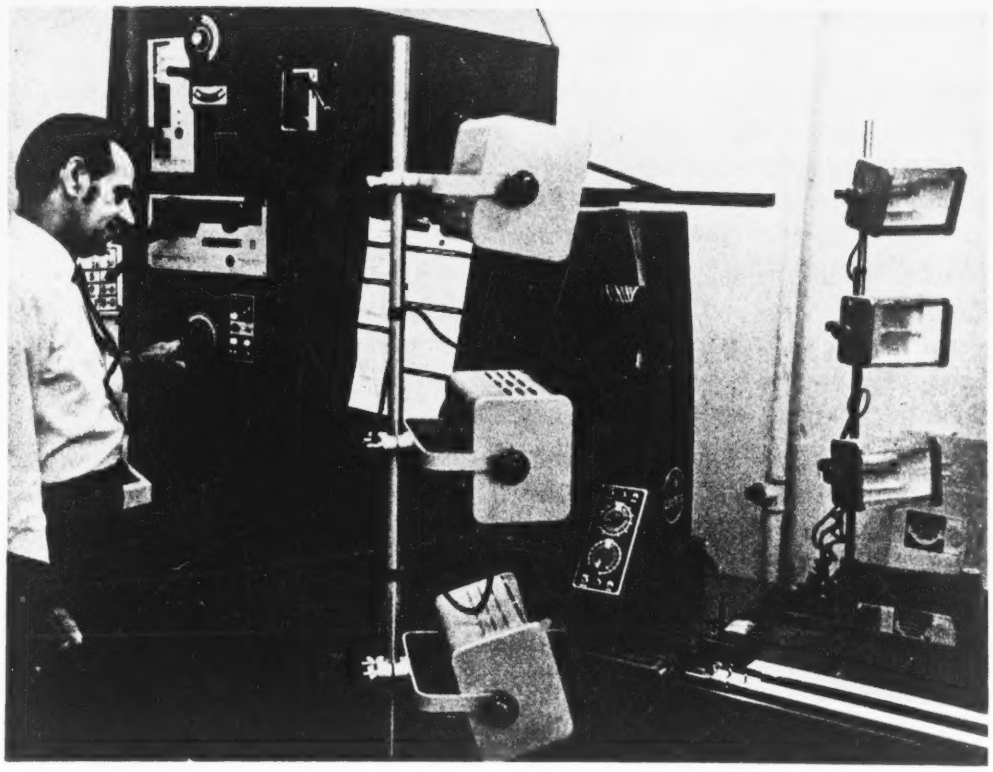
1730 North Lynn St., Arlington, Va. 22209.

See page 517 for additional sources of information.

PHOTOENGRAVERS

(D.O.T. 971.281 and .382)

Nature of the Work



Photoengravers make metal printing plates of illustrations and other copy that cannot be set up in type. The printing surfaces on these plates stand out in relief above the nonprinting spaces, as do the letters and the accompanying type. Similarly, gravure photoengravers, a specialized type of photoengraver, make gravure plates in which the image is etched below the surface for use in reproducing pictures and type.

In making a photoengraving plate for the letterpress process, the entire job may be done either by one man or by a number of skilled workers, each specializing in a particular operation. Specialists include cameramen, printers, etchers, finishers, routers, blockers, and proofers. In the large shops, the work is divided almost always among a number of these specialists.

A *cameraman* starts the process of making a photoengraving plate by photographing the material to be reproduced. Plates made from line drawings are called line plates and those from photographs are called halftone plates. After the cameraman develops the negative, the *printer* prints the image on a metal plate by coating the plate with a solution sensitive to light and then exposing it and the negative to arc lights. The image areas are protected by chemicals so that when the plate is placed in an acid bath by the *etcher,* only the nonimage areas are etched away. The image areas that are left stand out in relief.

A number of other photoengraving operations may be performed, depending on the quality of the printing required. Photoengravings for very high quality books or periodicals, for example, require more careful finishing than those for newspapers. The *finisher* carefully inspects and touches up the plate with handtools; the *router* cuts away metal from the nonprinting part of the plate to prevent it from touching the inking rollers during printing; the *blocker* mounts the engraving on a suitable base to make it reach the right height; and the *proofer* prints a sample copy on a proof press.

The operations involved in gravure photoengraving are much like those in letterpress photoengraving, except that the image areas rather than the background are etched away.

Places of Employment

An estimated 17,000 journeymen photoengravers were employed in 1970. About two-thirds of them were employed in commercial service shops where the main business is making photoengravings for use by others. Newspaper and rotogravure shops employ several thousand photoengravers. In addition, book and periodical shops and the U.S. Government Printing Office also employ photoengravers. Many of these craftsmen have their own shops. Photoengravers' jobs are highly concentrated in the largest printing centers, particularly New York, Chicago, Philadelphia, and Los Angeles.

Gravure photoengravers work mainly in independent gravure plants. Most of them work for the small number of big firms which handle a large proportion of all gravure work. A few large newspaper and commercial plants also have departments where this work is done. Gravure plants are concentrated in a few States, particularly New York, Pennsylvania, Illinois, and Kentucky.

Training and Other Qualifications

The most common way to become a photoengraver is through apprenticeship training. At the beginning of 1970, about 630 registered apprentices were in training for skilled photoengraving occupations. The apprenticeship program generally covers a 5 year period and includes at least 800 hours of related classroom instruction. Besides the care and use of tools, the apprentice is taught to cut and square negatives, make combination plates, inspect negatives for defects, mix chemicals, sensitize metal, and operate machines used in the photoengraving process.

Apprenticeship applicants must be at least 18 years of age and generally must have a high school education or its equivalent preferably with courses in chemistry and physics and training in art. Credit for previous experience acquired in photoengraving work may shorten the required apprenticeship time. Many employers require a physical examination for prospective photoengravers; the condition of the applicant's eyes is particularly important because a photoengraver's duties involve constant close work and color discrimination.

Employment Outlook

A few hundred job openings are expected each year through the 1970's because of the need to replace photoengravers who retire, die, or transfer to other occupations. However, the total number of these craftsmen is expected to decline slowly despite the growing use of photographs and other illustrations, and the increasing use of color. The application of electronics to engraving and to color separation, improved photographic equipment, and the increasing use of offset printing, which requires no photoengravings, will limit the number of photoengravers needed.

Earnings and Working Conditions

Photoengravers are among the highest paid printing craftsmen. The average union minimum hourly wage rate for photoengravers in 69 large cities on July 1, 1970, was $5.73 in book and job shops and $5.56 for the day shift in newspaper plants. Union minimum hourly rates ranged from $3.83 an hour in Shreveport, La., to $6.53 an hour in Chicago.

Most photoengravers are union members. Nearly all unionized photoengravers are represented by the Lithographers and Photoengravers International Union.

Sources of Additional Information

American Photoplatemakers Association, 166 West Van Buren St., Chicago, Ill. 60604.

Lithographers and Photoengravers International Union, 233 West 49th St., New York, N.Y. 10019.

Printing Industries of America, Inc., 1730 North Lynn St., Arlington, Va. 22209.

See page 517 for additional sources of information.

ELECTROTYPERS AND STEREOTYPERS

(D.O.T. 974.381 and 975.782)

Nature of the Work

Electrotypers (D.O.T. 974.381) and *stereotypers* (D.O.T. 975.782) make duplicate press plates of metal, rubber, and plastic for letterpress printing. These plates are made from the metal type forms prepared in the composing room. Electrotypes are used mainly in book and magazine work. Stereotypes, which are less durable, are used chiefly in newspaper work. Electrotyping and stereotyping are necessary because most volume printing requires the use of duplicate printing plates. When a large edition of a book, magazine, or newspaper is printed, several plates must be used to replace those which become too worn to make clear impressions. Also, by having duplicate plates, printers can use several presses at the same time and finish a big run quickly. This is especially important in publishing daily newspapers. Furthermore, many big plants use rotary presses which require curved plates made by either electrotyping or stereotyping from flat type forms.

Several steps are required to produce a duplicate, curved metal plate for use in the pressroom. In electrotyping, a wax or plastic mold of the type form is made and coated with special chemical solutions before being suspended in an electrolytic solution containing metal. This leaves a metallic shell on the coated mold; this shell is stripped from the mold, backed with metal or plastic, and carefully finished.

The stereotyping process is much simpler, quicker, and less expensive than electrotyping, but it does not yield as durable or as fine a plate. Stereotypers make molds or mats of paper-maché (a strong material composed of paper pulp) instead of wax or plastic. The mat is placed on the type form and covered with a cork blanket and sheet of fiberboard. The covered form is run under heavy power-driven steel rollers to impress the type and photoengravings on the mat. Then the mat is placed in a stereotype casting machine which casts a composition lead plate on the mold. In many of the larger plants, stereotype plates are cast in automatic machines.

In many of the larger plants, electrotypers and stereotypers perform only one phase of the work, such as casting, molding, finishing, or blocking. However, journeymen must know how to handle all the tasks involved in their respective trades.

Many electrotypers work in large plants that print books and periodicals. Most stereotypers work in newspaper plants, but some are employed in large commercial printing plants. Electrotypers and stereotypers also are employed in independent service shops which do this work for printing firms.

Training and Other Qualifications

Nearly all electrotypers and stereotypers learn their trades through apprenticeship. Electrotyping and stereotyping are separate crafts, and little transferability takes place between the two. The apprenticeship program of each trade covers all phases of the work and almost always includes classes in related technical subjects as well as training on the job. Apprenticeship training for electrotypers and stereotypers usually covers a 5- or 6-year period of reasonably continuous employment.

Apprenticeship applicants must be at least 18 years of age and, in most instances, must have a high school education or its equivalent. If possible, this education should include mechanical training and courses in chemistry. Physical examinations and aptitude tests often are given to prospective apprentices.

Employment Outlook

There will be some opportunities for new workers to become electrotypers and stereotypers through the 1970's because of retirements, deaths, or transfers of workers to other occupations. However, the total number of electrotypers and stereotypers is expected to continue to decline moderately.

This decline will occur in spite of the anticipated increase in the total volume of printing because of technological changes. For example, the increasing use of automatic plate casting eliminates many steps in platemaking, and plastic and rubber plates are being made increasingly outside electrotyping and stereotyping shops. Furthermore, the increasing use of offset printing reduces the need for electrotypers and stereotypers, since this type of plate is not required in offset printing.

Earnings and Working Conditions

On July 1, 1970, the union minimum hourly wage rates in 69 large cities averaged $4.91 an hour for electrotypers, $5.23 an hour for stereotypers in book and job shops, and $4.87 an hour for stereotypers on day shift in newspaper plants. Union minimum hourly wage rates for electrotypers in book and job plants ranged from $3.95 an hour in Baltimore, Md., to $5.57 an hour in New York, N.Y., and Newark, N.J. In newspaper plants, rates for day-shift stereotypers ranged from $3.83 an hour in Shreveport, La., to $6.66 an hour in Chicago, Ill.

Much of the work requires little physical effort since the preparation of duplicate printing plants is highly mechanized. However, some lifting of relatively heavy, hot press plates is required.

Nearly all electrotypers and stereotypers are members of the International Stereotypers' and Electrotypers' Union of North America.

Sources of Additional Information

International Stereotypers' and Electrotypers' Union of North America, 10 South La Salle St., Chicago, Ill. 60603.

International Association of Electrotypers and Stereotypers, Inc., 758 Leader Building, Cleveland, Ohio 44114.

Printing Industries of America, 1730 North Lynn St., Arlington, Va. 22209.

See page 517 for additional sources of information.

PRINTING PRESSMEN AND ASSISTANTS

(D.O.T. 651.782, .885, and .886)

Nature of the Work

The actual printing operation is performed in the pressroom. Printing pressmen "makeready" (prepare) type forms and press plates for final printing and tend the presses while they are in operation.

The object of makeready, which is one of the most delicate and difficult parts of the pressman's work, is to insure printing impressions that are distinct and uniform. This is accomplished by means such as placing pieces of paper exactly the right thickness underneath low areas of the press plates to level them, and by attaching pieces of tissue paper to the surface of the cylinder or flat platen which makes the impression. Pressmen also have to make many other adjustments—for example, those needed to control margins and the flow of ink to the inking roller. In some shops, they are responsible not only for tending the presses but also for oiling and cleaning them and making some minor repairs. On the larger presses, pressmen have assistants and helpers.

Pressmen's work may differ greatly from one shop to another, mainly because of differences in the kinds and sizes of presses used. Small commercial shops generally have small and relatively simple presses that often are fed paper by hand. At the other extreme are the enormous web-rotary presses used by the larger newspaper, magazine, and book printing plants. These giant presses are fed paper in big rolls called "webs," up to 50 inches or more in width. They print the paper on both sides by means of a series of cylinders; cut, assemble, and fold the pages; and, finally, count the finished newspaper sections which emerge from the press ready for mailing. Each of these automatic steps calls for constant attention. Presses of this kind are operated by crews of journeymen and less skilled workers under the direction of a *pressman-in-charge.*

Although the basic duties of *lithographic (offset) pressmen* are similar to those of letterpress and gravure pressmen, a number of differences exist, principally because of the specialized character of lithographic presses. (See p. 525 for further details.)

Press assistants feed sheets of paper into presses and help pressmen operate large and complicated rotary presses. Workers whose main responsibility is feeding often are called *press feeders.* The ratio of assistants to pressmen depends on the size of the plant, type of press, and other factors, and differs from one plant to another. Many shops are too small to have pressroom assistants.

Training and Other Qualifications

As in other printing crafts, apprenticeship is the most common way to become a pressman. Some workers have learned the skills of the trade while working as helpers or press assistants or through a combination of work experience in the pressroom and vocational or technical school training.

The length of apprenticeship and the content of training depend largely on the kind of press used in the plant. The apprenticeship period in commercial shops is 2 years for press assistants and 4 years for pressmen. In newspaper establishments the apprenticeship period is 5 years. The apprenticeship period for pressmen operating web presses is generally 5 years. On-the-job training includes the care of pressroom equipment, makeready, running the job, press tending and maintenance and working with various types of inks and papers. In addition to on-the-job instruction, the apprenticeship includes related classroom or correspondence schoolwork. At the beginning of 1970, about 3,000 registered apprentices were in training.

Individual companies generally choose apprentices from among press assistants and others already employed in the plant. Young men often may work for 2 or 3 years in the pressroom before they are selected to begin 2- to 4-year training periods leading to journeyman status. A high school education or its equivalent generally is required. Because of technical developments in the printing industry, a year of

chemistry and a year of physics should be included. Mechanical aptitude is important in making press adjustments and repairs. An ability to visualize color is essential for work on color presses, which are being used increasingly. Physical strength and endurance are necessary for work on some kinds of presses, where the pressmen have to lift heavy type forms and press plates and stand for long periods.

Employment Outlook

Employment of pressmen is expected to increase moderately through the 1970's. In addition, a few thousand job openings will arise each year because of the need to replace workers who retire, die, or transfer to other occupations.

More pressmen will be needed because of growth in the amount of printed materials. Employment growth, however, will be limited by continued improvements in the efficiency of printing presses.

Earnings and Working Conditions

The earnings of pressmen depend upon the kind of press operated, the type of printing plant, and the geographical area of employment. A survey of union minimum hourly wage rates for day-work in 69 large cities shows that the average minimum hourly rate in effect on July 1, 1970 for newspaper pressmen-in-charge was $5.24; for newspaper pressmen (journeymen), $4.94; for book and job cylinder pressmen, $5.00; for book and job platen pressmen, $4.46; and for book and job press assistants and feeders, $4.26.

Pressrooms are unavoidably noisy. Pressmen working in certain areas frequently wear ear protectors. They are subject to hazards when working near machinery. Pressmen often have to lift heavy type forms and printing press plates. At times, they work under pressure to meet deadlines, especially in the printing of newspapers and magazines. Many pressmen work night shifts for which the rate of pay is higher than the basic day rate.

Most pressroom workers are covered by union agreements. Practically all of the organized letterpress and gravure pressmen are members of the International Printing Pressmen and Assistants' Union of North America.

Sources of Additional Information

International Printing Pressmen and Assistants' Union of North America, Pressman's Home, Tenn. 37850.

Printing Industries of America, Inc., 1730 North Lynn St., Arlington, Va. 22209.

See page 517 for additional sources of information.

LITHOGRAPHIC OCCUPATIONS

Nature of the Work

Lithography (offset printing) is one of the most rapidly growing methods of printing. Practically all items printed by other processes also are produced by lithography—including books, calendars, maps, posters, labels, office forms, catalogs, folding cartons, and newspapers. Lithography has special advantages when the copy to be reproduced includes photographs, drawings, or paintings, since the rubber blanket which transfers the image from the plate to the surface to be printed permits greater flexibility in the type of paper that can be used.

Several operations are involved in lithography, and each is performed by a specialized group of workers. The main groups of lithographic workers are cameramen, artists and letterers, strippers, platemakers, and pressmen.

The *cameraman* (D.O.T. 972.-382) starts the process of making a lithographic plate by photographing the copy. He generally is classified as a line cameraman (black and white), halftone cameraman (black and white), or color separation photographer.

After the negatives have been made, they frequently need retouching to lighten or darken certain parts. Thus, it is often necessary for a *lithographic artist* (D.O.T. 972.281) to make corrections by sharpening or reshaping images on the negatives. Highly skilled workers perform this work by hand, using chemicals, dyes, and special tools.

To qualify as journeymen, these artists must be adept in one or more of the various retouching methods. Like cameramen, they are assigned to only one phase of the work and may customarily be known, for example, as dot etchers, retouchers, or letterers.

The *stripper* (D.O.T. 971.381) makes layouts on paper, glass, or film. He arranges and pastes film or prints of type, pictures, and other art work on the layout sheets called flats or "stripups," from which photographic impressions are made for the lithographic press plates. The job of the stripper in the lithographic process corresponds to that

of the makeup man in the letterpress process.

In lithography, employees in the platemaking department expose press plates to photographic films which are made by the cameramen and corrected by artists. The *platemaker* (D.O.T. 972.781) may cover the surface of the metal plate with a coating of photosensitive chemicals, or the metal plate may come to him with the photosensitive layer applied. The platemaker exposes the sensitized plate through the negative or positive to strong arc lights; this is commonly done in a vacuum printing frame. When a large number of the same images are to be exposed on a single plate, however, the operation is done in a photocomposing machine. The plate then is developed and chemically treated to bring out the image.

The *lithographic pressman* (D.O.T. 651.782) makes ready and tends the lithographic (offset) printing presses. He installs the plate on the press, adjusts the pressure for proper printing, cares for and adjusts the rubber blanket which takes the impression from the plate and transfers it to the paper, adjusts water and ink rollers for correct operation, mixes inks, and operates the presses. Basically, the duties of these workers are similar to those of letterpress and gravure pressmen. Some differences exist, however, because of the chemical means used to separate image and nonimage areas on lithographic presses. In large plants, press feeders and helpers are employed; their duties are similar to those of assistants and helpers to letterpress and gravure pressmen. (See p. 524)

Training and Other Qualifications

A 4- or 5-year apprenticeship covering the basic lithographic process usually is required to become a well-rounded lithographic craftsman. The specific occupation in which journeyman status is being sought is emphasized although an attempt is made to make the apprentice familiar with all lithographic operations. At the beginning of 1970, about 3,350 registered apprentices were being trained for skilled lithographic occupations.

Usually, apprenticeship applicants must be in good physical condition, high school graduates, and at least 18 years of age. Aptitude tests are sometimes given to prospective apprentices. Vocational school training and training in photography, mathematics, chemistry, physics, and art are helpful in learning these crafts.

Employment Outlook

Employment of journeymen lithographic workers, who numbered about 80,000 in 1970, is expected to increase moderately through the 1970's. In addition, the need to replace workers who retire, die, or transfer to other fields of work will provide some job openings.

Employment of lithographic workers is expected to increase in response to the continued growth of offset printing. Commercial printing firms and small and medium size newspaper publishers increasingly are using offset presses. Employment growth also will be stimulated by the greater use of photographs and drawings in printed matter, and by the more widespread use of color in many printed products. However, new technological developments, particularly in the camera, platemaking, and press departments, are expected to limit the increase in lithographic employment.

Earnings and Working Conditions

Union minimum hourly wage rates for lithographic occupations vary within each occupation, and depend upon the degree of skill required, the type and size of equipment, and the part of the country in which the worker is employed. For example, according to information on union minimum hourly wage rates in 69 large cities as of July 1, 1970, wage rates for cameramen, dot etchers or process artists, and letterers ranged from $3.71 an hour in Little Rock, Ark., to $6.46 an hour in Boston, Mass. Minimum hourly rates of platemakers ranged from $3.71 an hour in Little Rock to $6.15 an hour in Boston. The wide range of rates for lithographic pressmen—from $2.96 an hour for small multilith press operators in Little Rock to $8.20 an hour for first pressmen on a large eight-plate roll-fed offset press in Chicago—is due largely to the many different types and sizes of presses operated.

A substantial proportion of all lithographic workers are members of the Lithographers and Photoengravers International Union. A considerable number of offset pressmen and other offset workers are members of the International Printing Pressmen and Assistants' Union of North America.

Sources of Additional Information

Lithographers and Photoengravers International Union, 233 West 49th St., New York, N.Y. 10019.

International Printing Pressmen and Assistants' Union of North America, Pressmen's Home, Tenn. 37850.

Graphic Arts Technical Foundation, 4615 Forbes Ave., Pittsburgh, Pa. 15213.

National Association of Photo-Lithographers, 230 West 41st St., New York, N.Y. 10036.

Printing Industries of America, Inc., 1730 North Lynn St., Arlington, Va. 22209.

See page 517 for additional sources of information.

BOOKBINDERS AND RELATED WORKERS

(D.O.T. 977.781)

Nature of the Work

Many printed items, such as books, magazines, pamphlets, business forms, and calendars, must be folded, sewed, stapled, or bound after they leave the printing shops. Much of this work is done by skilled *bookbinders* (D.O.T. 977.781) who numbered nearly 30,000 in 1970. Many bookbinders are employed in shops whose chief business is bookbinding. However, a considerable number are employed in the bindery departments of large book, periodical, and commercial printing plants and large libraries.

There are several different kinds of binderies. Edition and pamphlet binderies bind books, magazines, and pamphlets printed in large quantities. Trade or job binderies do bindery work on contract for printers, publishers, or other customers. Blankbook and looseleaf binderies bind various types of blank books such as ledgers and bookkeeping and accounting volumes. They also produce looseleaf binders and bind books in looseleaf form.

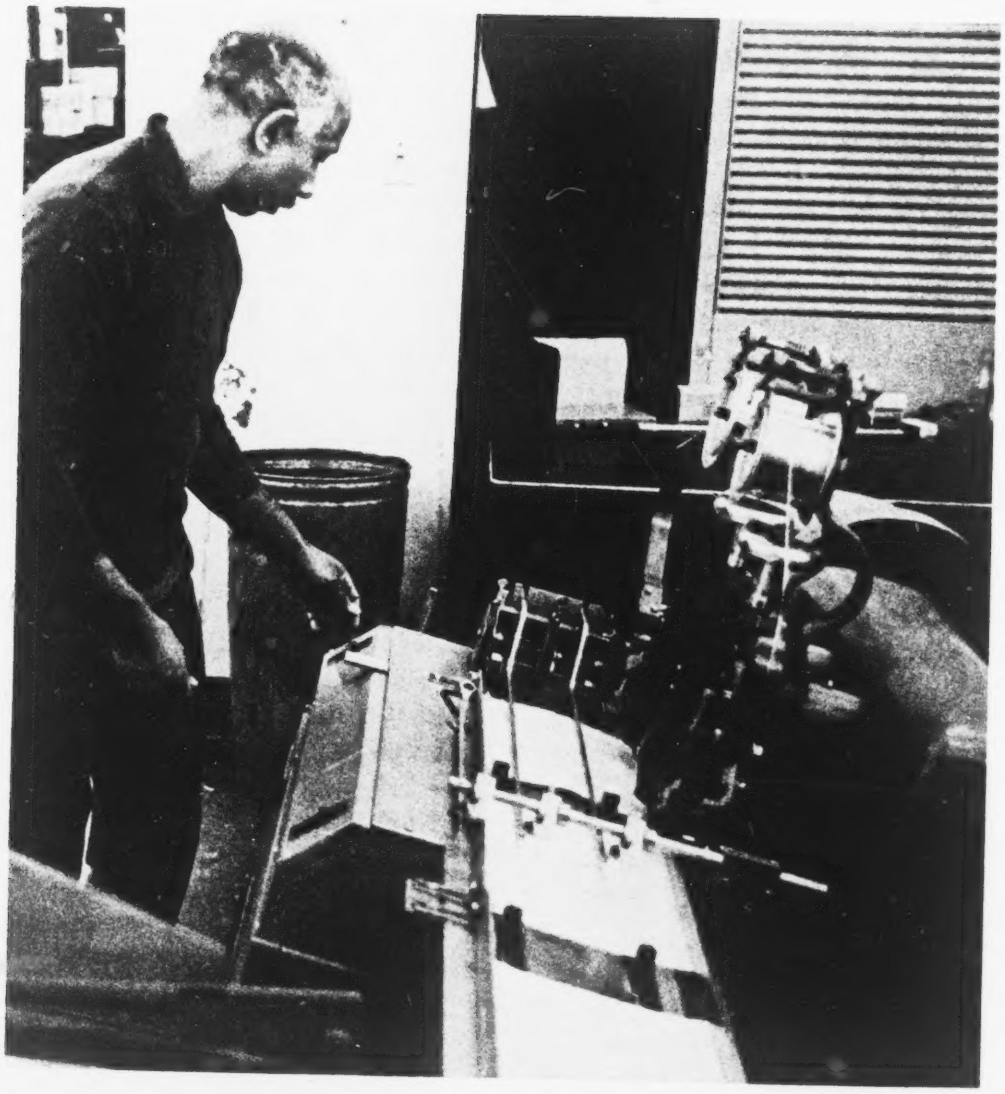
Edition binding—making books in quantity from big, flat printed sheets of paper—is by far the most complicated. The first step is to fold the printed sheets into one unit or more, known as "signatures," so that the pages will be in the right order. The next steps are to insert any illustrations that have been printed separately, to gather and assemble the signatures in proper order, and to sew them together. The resulting book bodies are shaped with power presses and trimming machines, and reinforced with glued fabric strips. Covers are glued or pasted onto the book bodies, after which the books undergo a variety of finishing operations and, frequently, are wrapped in paper jackets. Machines are used extensively throughout the process.

Skilled bookbinders seldom perform all the different edition bindery tasks, although many journeymen have had training in all of them. In large shops, skilled bookbinders may be assigned to one or a few operations, most often to the operation of complicated machines.

In many binderies, especially large ones, much of the work is done by workers trained in only one operation or in a small number of relatively simple, related tasks. Most of these workers, often classified as bindery workers or bindery hands, are women (hence the common designation, bindery women). Their work closely resembles assembly line factory work.

Training and Other Qualifications

A 4- or 5-year apprenticeship which includes on-the-job training as well as related classroom instruction generally is required to qualify as a skilled bookbinder. Apprenticeship programs may vary considerably among the various types of bookbinding shops. When large quantities of books are bound on a



mass production (edition) basis, the most modern machine methods are used. In fine hand binding, hand methods, including artistic designing and decorating of leather covers are used. For many years, hand bookbinding has been declining in importance.

Apprenticeship applicants usually must have a high school education, mechanical aptitude, and be at least 18 years of age. During the apprenticeship, trainees learn to assemble signatures, renovate old, worn bindings, and use various binding machines such as punches and folders.

For the less skilled bindery occupations, the training period may last from several months to 2 years. In union shops, apprenticeship programs for women bindery workers generally last 2 years. These formal programs include classroom instruction as well as on-the-job training.

Employment Outlook

Several hundred job openings are expected each year during the 1970's because of the need to replace experienced workers who retire, die, or transfer to other occupations. Many openings are expected for bindery hands, most of whom are women, because of the considerable turnover among this group. However, some decrease in the total number of bookbinders and bindery hands is expected, despite the anticipated growth in the amount of bound printed materials, because of the increasing mechanization of bindery operations.

Earnings and Working Conditions

Wage rates for skilled bookbinders tend to be below the average of other printing crafts. A survey of union minimum hourly wage rates in 69 large cities, as of July 1, 1970, showed that the minimum hourly wage rate for bookbinders in book and job establishments averaged $4.89 an hour, and rates ranged from $2.69 an hour in Syracuse, N.Y., to $6.06 in New York, N.Y. The wage rates for bindery women are considerably lower and are among the lowest for printing industry workers. They ranged from $2.15 an hour in Shreveport, La., to $3.41 an hour in the San Francisco area.

Most bindery workers are union members. Most skilled bookbinders are represented by the International Brotherhood of Bookbinders.

Sources of Additional Information

International Brotherhood of Bookbinders, 1612 K St., NW., Washington, D.C. 20016.

Printing Industries of America, Inc., 1730 North Lynn St., Arlington, Va. 22209.

See page 517 for additional sources of information.

SOME OTHER MANUAL OCCUPATIONS

ASSEMBLERS

Nature of the Work

Television sets, automobiles, and refrigerators are typical of the manufactured products which undergo many assembly operations. The parts for these and thousands of other products are put together by assemblers, most of whom are semiskilled workers.

Some assemblers, known as floor assemblers, put together large, heavy machinery or equipment on shop floors, often fastening parts with bolts, screws, or rivets. Others, known as bench assemblers, put together small parts to make subassemblies or small complete units while working at a bench. Many assemblers work on items which move automatically past their work stations on conveyors. These workers must complete their assembly job within the time it takes the part or product to pass their work station.

The job duties of assemblers depend upon the product being manufactured, and the process being used. In aircraft and missile production, these workers may assemble and install parts into subassemblies. In the automobile industry, one assembler may start nuts on bolts, and the next worker tightens the nuts with power-driven tools. Assemblers in electronic plants may connect parts with electrical wire.

The kinds of tools assemblers use depend upon the work they are doing and the product on which they are working. Pliers, screwdrivers, soldering irons, power drills, and wrenches are among the common tools used by semiskilled assemblers.

Skilled assemblers work on the more complex parts of subassemblies with little or no supervision and are responsible for the final assembly of complex jobs. These workers must know how to read blueprints and other engineering specifications and use a variety of tools and precision measuring instruments. In relatively new fields such as electronics, instrumentation, and missiles, subassembly work may require a high degree of skill.

Places of Employment

In 1970, approximately 865,000 assemblers were employed in manufacturing plants; the great majority were in plants that made fabricated metal products, electric and nonelectric machinery, and motor vehicles. More than half of all assemblers were employed in California, New York, Michigan, Illinois, Ohio, New Jersey, and Pennsylvania.

About half of all assemblers are women. They work primarily as bench assemblers because such work is relatively light and often involves handling delicate objects. This is particularly true in the electrical and electronic equipment industry. Men are usually employed as floor or line assemblers, where the work is physically hard. Final automobile assembly, for example, is generally done by men.

Training, Other Qualifications, and Advancement

Inexperienced people who are hired to do assembly work are usually trained on the job in a few days or weeks. The new worker may have his job duties explained to him by his supervisor and then be placed under the direction of an experienced employee. When the new worker has developed sufficient speed, he is placed "on his own" and is responsible for the work he does.

Employers seek applicants who are physically fit and dependable, and who have some aptitude for mechanical work. High school graduates or workers who have taken vocational school courses, such as blueprint reading, are preferred by many employers, although a high school diploma is not usually required. Generally, for production-line jobs, employers look for applicants who can do routine work at a fast pace. For other types of assembly jobs, applicants may have to meet special requirements. For example, in plants producing electrical and electronic products, which may contain many different colored wires, applicants often are tested for color blindness.

A relatively small number of workers who learn to perform a variety of assembly jobs and who have a knowledge of blueprint reading and shop mathematics may become skilled assemblers. A few also may become skilled inspectors or foremen.

Employment Outlook

Employment of assemblers is expected to increase moderately through the 1970's. However, most job openings will result as workers retire, die, or transfer to other occupations. Overall, thousands of openings will become available each year.

Manufacturing plants will need more assemblers to produce goods for the Nation's growing economy. Growth in population and personal income will increase the demand for consumer products such as automobiles and household appliances. Business expansion will increase the demand for industrial machinery and equipment. Employment of assemblers, however, is not expected to keep pace with manufacturing output because the automation of assembly processes and other laborsaving innovations are expected to raise output per worker.

Employment in plants that produce durable goods, such as automobiles and aircraft, is particularly sensitive to changes in business conditions and national defense needs. Therefore, assemblers in these plants will be subject to occasional layoffs.

Earnings and Working Conditions

National wage data on assemblers are not available. However, information from a limited number of union-management contracts indicate that wages ranged from $2.15 to $3.75 an hour in 1970. Variation in wages depends on geographic area, industry, and type of assembly work.

The working conditions of assemblers differ, depending on the particular job performed. Assemblers of electronic equipment may put together small components at a bench in a room which is clean, well lighted, and free from dust. Floor assemblers of industrial machinery, on the other hand, may install and assemble heavy parts and are often exposed to contact with oil and grease. Workers on assembly lines may be under pressure to keep up with the speed of the lines. Some assemblers are paid incentive or piece-work rates, and are encouraged to work more rapidly by the prospect of higher earnings.

Many assemblers are members of labor unions. These unions include the International Association of Machinists and Aerospace Workers; the International Union of Electrical, Radio and Machine Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; and the International Brotherhood of Electrical Workers. Most labor-management contracts provide for fringe benefits such as holiday and vacation pay, health insurance, life insurance, and retirement pensions.

Sources of Additional Information

Additional information about employment opportunities for assemblers may be available from local offices of the State employment service.

AUTOMOBILE PAINTERS

(D.O.T. 845.781)

Nature of the Work

Automobile painters make old and damaged motor vehicles "look like new." These skilled workers repaint vehicles that have lost the luster of their original paint, and the repaired portions of vehicles damaged in traffic accidents. (Production painters who work for motor vehicle manufacturers are discussed elsewhere in the *Handbook.*)

To prepare an automobile for painting, the painter or his helper rough sands the vehicle to remove original paint and rust. He then uses a spray gun to apply primer coats to the automobile surface. After the primer dries, he sands the surface until it is smooth enough to be painted. For rough sanding, he usually uses a pneumatic or electric sander and a coarse grade of sandpaper; final sanding may be done by hand, using a fine grade of sand paper. Small nicks and scratches that cannot be removed by sanding are filled with automobile-body putty. Masking tape and paper are used to cover areas not to be painted.

Before painting repaired portions of an automobile, the painter may mix paints to match the existing color of the car. Before applying the paint, he adjusts the nozzle of the spray gun according to the kind of lacquer or enamel being used and, if necessary, adjusts the air-pressure regulator to acquire the needed amount of pressure. He must handle the spray gun skillfully so that the paint is applied evenly, rapidly, and thoroughly. To speed drying, he may place the freshly painted automobile under heat lamps or in a

special infrared oven. After the paint dries, the painter or his helper may polish the newly painted surface to bring out its luster.

Places of Employment

Almost two-thirds of an estimated 30,000 automobile painters employed in 1970 worked in repair shops that specialize in automobile-body repairs and painting, and in shops that make general automobile repairs. Most of the others were employed in the service departments of automobile and truck dealers. Some painters were employed by organizations that maintained and repaired their own fleets of motor vehicles, such as trucking companies and bus lines.

Although automobile painters are employed in every section of the country, about half of them work in the nine States with the largest number of motor vehicles: California, Texas, New York, Ohio, Pennsylvania, Illinois, Michigan, Florida, and New Jersey.

Training, Other Qualifications, and Advancement

Most automobile painters start as helpers and acquire their skills informally by working for several years with experienced painters. Usually, beginners remove automobile trim, clean and sand surfaces to be painted, and polish painted surfaces. As helpers gain experience, they progress to more complicated tasks such as using spray guns to apply primer coats and paint small areas. Three to four years of informal on-the-job training are required to become a fully qualified automobile painter.

A small number of automobile painters learn their trade through apprenticeship. Apprenticeship programs for automobile painters, which generally last 3 years, consist of on-the-job training supplemented by related classroom instruction.

Training programs for unemployed and underemployed workers seeking entry jobs as automobile painters are in operation in several cities under provisions of the Manpower Development and Training Act. Persons who complete these programs, which usually last up to a year, generally need additional on-the-job or apprenticeship training to qualify as skilled painters.

Young persons considering this work as a career should have good health, keen eyesight, a discerning color sense, and a steady hand. Courses in automobile-body repair offered by high schools and vocational schools provide helpful experience. Completion of high school is generally not a requirement but may be an advantage in getting a job as a painter's helper, because to many employers high school graduation indicates that a young man can "complete a job."

An experienced automobile painter with supervisory ability may advance to shop foreman. Many experienced painters who acquire the necessary capital open their own shops.

Employment Outlook

Employment of automobile painters is expected to increase moderately through the 1970's. In addition to the few hundred job openings resulting from employment growth, several hundred openings are expected each year because of the need to replace experienced painters who retire or die. Job openings also will occur as some painters transfer to other occupations.

Employment of automobile painters is expected to increase primarily because more motor vehicles will be damaged in traffic accidents as the number of vehicles in use grows. This accident toll will increase, even though new and improved highways, driver training courses, added safety features on new vehicles, and stricter law enforcement may slow down the rate of growth. Despite the increasingly durable paint used on new cars, the number of motor vehicles that need to be repainted because the original finish has deteriorated also is expected to increase.

The favorable employment effect of increasing numbers of motor vehicles and traffic accidents may be offset slightly by improvements that make automobile bodies more resistant to rust, and new developments in painting equipment that should enable painters to complete jobs in less time.

Earnings and Working Conditions

Automobile painters employed by automobile dealers in 33 cities had average straight-time hourly earnings of $5.59, based on a survey in late 1969. Average hourly earnings of these workers in individual cities ranged from $3.45 in Providence–Pawtucket, R.I., to $7.60 in Detroit, Mich. Skilled painters usually earn between two and three times as much as inexperienced helpers and trainees.

Many painters employed by automobile dealers and independent repair shops are paid a commission based on the labor cost charged to the customer. Under this method, a painter's earnings depend largely on the amount of work he is assigned and how fast he completes it. Employers frequently guarantee their commissioned painters a minimum weekly salary. Helpers and trainees usually are paid an hourly rate until they are sufficiently skilled to work on a commission basis. Painters employed by trucking companies, buslines, and other organizations that repair their own vehicles usually receive an hourly rate. Most painters work 40 to 48 hours a week.

Many employers of automobile painters provide holiday and vacation pay, and additional benefits such as life, health, and accident insurance, and contribute to retirement plans. Some shops furnish laundered uniforms free of charge.

Automobile painters are exposed to fumes from paint and paint-mixing ingredients. However, in most shops, the painting is performed in special ventilated booths that protect the painters. Masks covering the nose and mouth are also used. Painters must be agile because they often bend and stoop while working. Only average physical strength is needed.

Many automobile painters belong to unions, including the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Most painters who are union members are employed by the larger automobile dealers and by trucking companies and buslines.

Sources of Additional Information

For further information regarding work opportunities for automobile painters, inquiries should be directed to local employers, such as automobile-body repair shops and automobile dealers; locals of the unions previously mentioned; or the local office of the State employment service. The State employment service also may be a source of information about the Manpower Development and Training Act apprenticeship, and other programs that provide training opportunities.

General information about the work of automobile painters may be obtained from:

Automotive Service Industry Association, 230 North Michigan Ave., Chicago, Ill. 60601.

Independent Garage Owners of America, Inc., 624 South Michigan Ave., Chicago, Ill. 60605.

AUTOMOBILE TRIMMERS AND INSTALLATION MEN (AUTOMOBILE UPHOLSTERERS)

(D.O.T. 780.381 and .884)

Nature of the Work

Automobile trimmers, frequently assisted by installation men, replace and repair upholstery and other automobile fabrics. Trimmers and installation men together are called "automobile upholsterers." (Workers who upholster automobiles in factories are not included in this statement.)

Automobile trimmers (D.O.T. 780.381) are skilled upholsterers who custom-make convertible tops; coverings for automobile seats, floors, and door panels; and other items. To make these items, they first determine the dimensions of each piece of vinyl, leatherette, broadcloth, or other material to be used and mark the material for cutting, after allowing for pleats, seams, shrinkage, and stretching. Although trimmers often follow standard designs to make most items, they may follow original designs specified by customers or create original designs. After cutting and fitting, they use heavy-duty sewing machines to stitch the pieces. Finished pieces are stretched and pulled to fit snugly; glued, tacked, stapled, or fastened in other ways; and then trimmed of excess material. In addition to making automobile upholstery and convertible tops, trimmers may make items such as truck seat cushions and tarpaulins, boat covers, and seats for buses and small airplanes. Automobile upholsters also repair upholstery that has been torn, cut, burned, or otherwise damaged. They may repair power-window and convertible top mechanisms, and cut and install automobile glass.

Automobile trimmers often are assisted by *installation men,* sometimes called seat-cover installers (D.O.T. 780.884), who remove worn seat covers and convertible tops and install new ones.

Trimmers and installation men use a variety of handtools including shears, knives, screwdrivers, special pliers, various types of wrenches, tack hammers, mallets, and tape measures. They also use heavy-duty sewing machines and power tools such as air-powered staplers and wrenches. In some shops, they use electric steaming machines to shrink fabrics, and special electronic welders to bind synthetic materials.

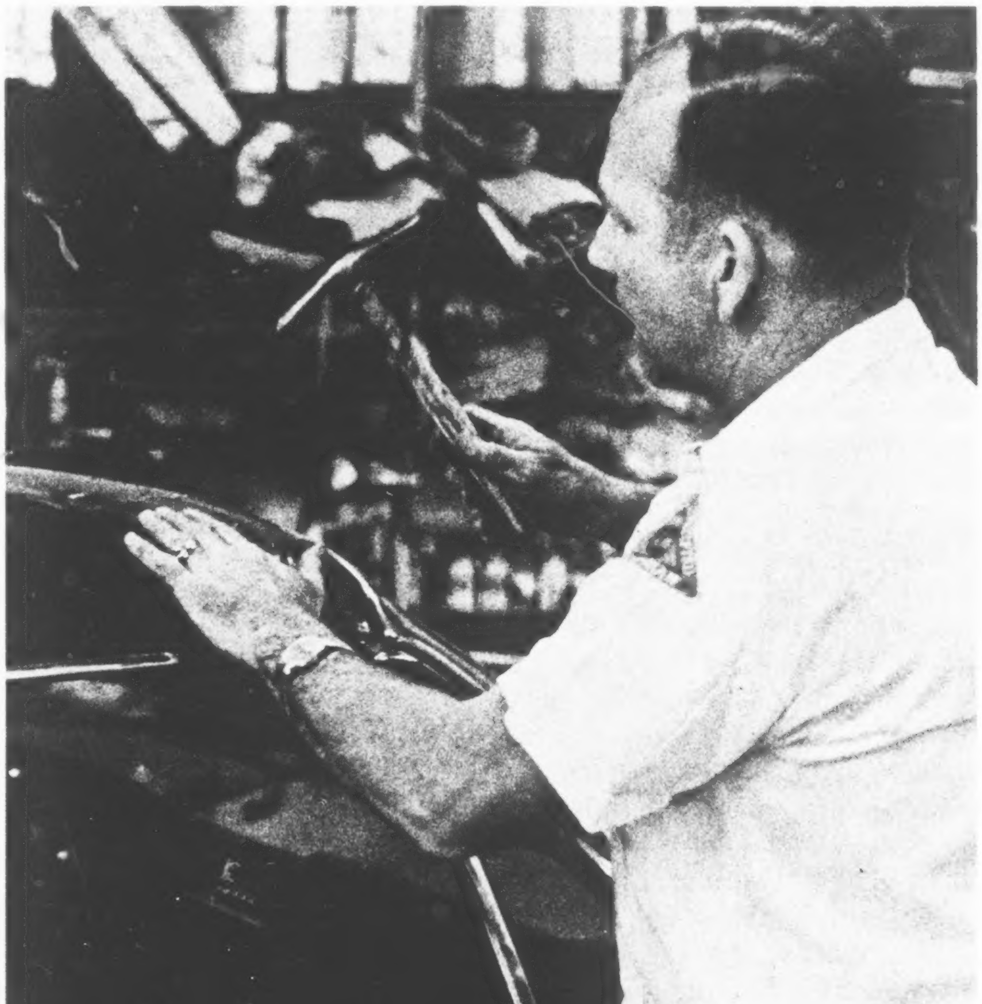
Places of Employment

Nearly 9,000 automobile trimmers and installation men were employed in 1970. Most worked in shops that specialize in the fabrication and replacement of automobile upholstery and convertible tops. Others worked in automotive repair and accessories sections of department stores, in automobile-body repair shops, and in automobile dealer shops. Most automobile upholstery shops employ from 1 to 5 trimmers. In small shops, the number of installation men generally equals the number of trimmers. However, installation men outnumber trimmers in many of the larger shops, particularly those that specialize in the installation of factory-made seat covers and tops.

Although automobile upholsterers are employed throughout the country, most work in the larger cities.

Training, Other Qualifications, and Advancement

Most trimmers and installation men learn their skills on the job.



Automobile upholsterer installs new convertible top.

Beginners usually are hired as installation men trainees. They are first taught to remove seats and upholstery and install seat covers, and gradually learn to do more difficult jobs such as installing convertible tops. After qualifying as installation men, they progress to making seat covers, tops, and other items. Although a capable beginner can become a fully qualified installation man in 3 to 6 months, 3 to 4 years usually are required to become a skilled trimmer.

A small number of automobile trimmers begin as apprentices. Apprenticeship programs for automobile trimmers, which usually last 3 or 4 years, consist of on-the-job training supplemented by related classroom instruction.

Training programs for unemployed and underemployed workers for entry jobs as automobile trimmers are in operation in several cities under the Manpower Development and Training Act. Persons who complete these programs, which usually last up to a year, may need additional on-the-job or apprenticeship training to qualify as skilled trimmers.

Applicants for entry jobs should be mechanically inclined and in good physical condition. Employers are interested in hiring those who enjoy working creatively with their hands. A high school education is desirable but not essential. High school and vocational school courses in furniture upholstering provide valuable training. Courses in mathematics are useful in laying out and planning upholstery work.

Experienced trimmers who have supervisory ability may advance to foremen in large shops. Many automobile upholstery shops are owned by trimmers who acquired the necessary experience, skill, and capital to establish their own businesses.

Employment Outlook

Employment of automobile trimmers and installation men is expected to increase moderately through the 1970's. In addition to the job openings resulting from employment growth, a few hundred openings are expected to result each year from the need to replace experienced workers who retire or die. Job openings also will occur as some trimmers and installation men transfer to other occupations.

Employment is expected to increase primarily because the growing number of automobiles will stimulate greater demand for custom-made automobile upholstery and other fabric products. However, the demand is not expected to grow as rapidly as the number of automobiles, because of the use of more durable fabrics. Other stimulants to employment growth include an increasing demand for truck cushions and tarpaulins because of growth in the number of trucks, and an increasing demand for custom-made boat covers and seats resulting from the growing popularity of boating.

Earnings and Working Conditions

According to information from a limited number of automobile upholstery shops, beginners earned from $1.60 to $2.25 an hour in 1970. Experienced installation men earned $2.30 to $3.10 an hour, and skilled trimmers earned $3.75 to $6.25 an hour. Individual earnings often depend on experience and location. Earnings generally are higher in large metropolitan areas than in small towns.

Most trimmers and installation men are paid a weekly salary or hourly wage and work from 44 to 48 hours a week. Many receive commissions or bonuses based on sales, in addition to their regular pay. Some trimmers are paid on a straight commission basis.

Trimmers and installation men receive holiday and vacation pay and all, or part, of the cost of life, health, and accident insurance. Some employers also contribute to retirement plans.

Trimmers and installation men generally work in shops that are clean, well-lighted, and relatively quiet. Their work often involves being in awkward and uncomfortable positions for short periods. Automobile upholstery work is not hazardous, although these workers are subject to cuts, bruises, and other minor injuries.

A small percentage of these workers are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.).

Sources of Additional Information

For further information regarding work opportunities for automobile trimmers and installation men, inquiries should be directed to local automobile upholstery shops or the local office of the State employment service. The State employment service also may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities.

General information about the work of automobile trimmers and installation men may be obtained from:

National Association of Auto Trim Shops, 129 Broadway, Lynbrook, L.I., N.Y. 11563.

BLACKSMITHS

(D.O.T. 356.381 and 610.381)

Nature of the Work

Blacksmiths make and repair various metal articles, such as machine and agricultural implement parts. They also sharpen chisels, drills, and similar tools. Blacksmiths join pieces of glowing hot metal by hammering them together, a process called forge or fire welding. In this process, they heat the metal in a special furnace called a forge, then place it on an anvil and shape it with presses and power hammers, and finish the piece with handtools such as chisels and hammers.

After making or repairing a metal article, the blacksmith may harden or temper it by heat-treatment. To harden metal, he first heats it to a high temperature in the forge, and then quickly cools it in an oil or water bath. To temper metal (make it more durable and less brittle), he also heats it, but to a lower temperature than for hardening. The metal is kept at this lower temperature for a specified time and then removed to cool gradually at air temperature.

An ancient skill practiced by many blacksmiths is shoeing horses; blacksmiths who specialize in this activity often are called farriers. Today most blacksmiths use ready-made horse shoes, but they may have to make or adjust shoes to achieve a proper fit.

The jobs of industrial blacksmiths and forge shop workers are similar. For a detailed discussion of jobs in forge shops, see the section on Forge Shop Occupations.

Places of Employment

In 1970, about two-thirds of the 12,000 blacksmiths employed in the United States worked as industrial blacksmiths, primarily performing maintenance and repair duties. Nearly half of the industrial blacksmiths worked in manufacturing industries, especially in the iron and steel industry, and also in the machinery, transportation equipment, and fabricated metal products industries. The railroad, construction, and mining industries also employed blacksmiths.

About one-third of all blacksmiths worked in small shops. Most of them were self-employed. These blacksmiths repair farm implements, tools, and mechanical equipment, and often perform other services such as welding, brazing, or tool sharpening. A small number of them specialize in the shoeing of horses.

Blacksmiths work in all parts of the country, in small rural communities as well as in large industrial centers. However, employment is concentrated in Pennsylvania, Texas, California, Illinois, Ohio, and New York. Horseshoers are found in all States and, especially, where there are numerous horses, horse farms, and race tracks.

Training and Other Qualifications

Most workers enter the occupation by obtaining jobs as helpers in blacksmith shops, where they gradually learn the trade on the job. Others enter through formal apprenticeship programs, which generally last 3 or 4 years. Apprenticeship programs customarily provide training in blueprint reading, proper use of tools and equipment, heat-treatment of metal, and forging methods, including forge welding. Most apprentices are found in large industrial firms rather than in small repair shops. Vocational school or high school courses in metalworking, blueprint reading, and mathematics are helpful to young persons interested in becoming blacksmiths.

Blacksmiths must be in good physical condition. Pounding metal and handling heavy tools and parts require considerable strength and stamina. The use of power hammers and hoists, however, reduces the physical demands of the work.

Employment Outlook

Employment of blacksmiths is expected to decline slowly through the 1970's. However, a few hundred job openings will arise each year to replace experienced workers who retire, die, or transfer to other occupations.

Employment is expected to decline because forge shops are producing a growing variety of small metal articles formerly made by blacksmiths. Metalworking operations once performed only by blacksmiths are being done by other specialized workers such as welders and forge shop craftsmen. It is often cheaper to replace small parts than to have a blacksmith repair them. However, the skills of all-round blacksmiths will continue to be required in the maintenance departments of large industrial firms and in many small metalworking and repair shops.

Earnings and Working Conditions

National earnings data for blacksmiths are not available. In union-management contracts covering a large number of blacksmiths in steel plants, railroad shops, and in the shipbuilding and petroleum industries, straight-time hourly pay rates ranged from $3.33 to $5.12 in 1970. Industrial blacksmiths generally work the same number of hours and have the same holidays, vacations, and other benefits as their fellow plant workers.

Blacksmith shops tend to be hot and noisy, but conditions have improved in recent years as a result of large ventilating fans and less vibration from machines. Blacksmiths are subject to hazards such as burns from forges and heated metals, and cuts, bruises, and other injuries from handling materials. Increased use of safety glasses, metal helmets, metal-tip shoes, face shields, ear plugs, and other protective equipment has helped reduce injuries.

Many blacksmiths belong to unions. One important union is the International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers. Other unions representing blacksmiths include the United Steelworkers of America, the Industrial Union of Marine and Shipbuilding Workers of America, and the International Union of Journeymen Horseshoers.

BOILERMAKING OCCUPATIONS

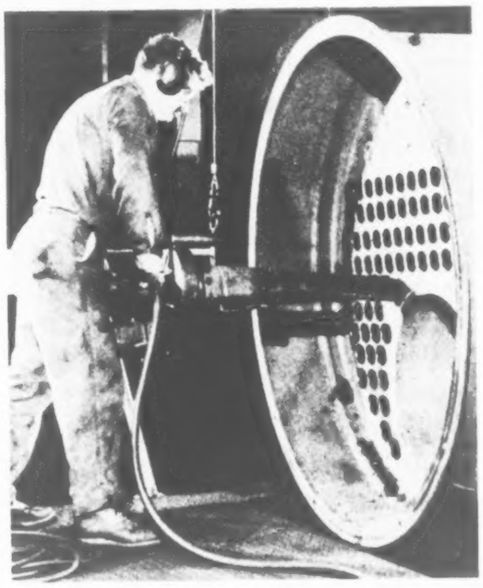
Nature of the Work

Boilermakers, layout men, and fitup men are skilled craftsmen who specialize in the repairing, fabricating, and assembling and disassembling of boilers, tanks, vats, pressure vessels, heat exchangers, and similar structures made of metal plate. These boilers and other metal vessels are used throughout industry to hold liquids and gases under pressure. Boilermakers are engaged primarily in erecting and repairing boilers and pressure vessels; layout men and fitup men usually are employed in manufacturing new boilers and heavy tanks. The repair work performed by boilermakers requires these workers to have all-round skills; fitup men and layout men have more specialized duties.

Boilermakers (D.O.T. 805.281). These craftsmen assemble and erect prefabricated parts and fittings at construction sites where boilers or other pressure vessels are used. After installation is completed, they conduct tests to check for defects. Boilermakers also repair all kinds of boilers. After first determining the cause of trouble, they may dismantle the boilers or other units and make repairs, such as patching weak spots with metal stock, replacing defective sections with new parts, or strengthening joints. In addition to those working at construction sites, a large number of boilermakers maintain and repair boiler and other pressure vessels in the powerplants of industrial firms. Installation and repair work performed by boilermakers often must meet standards set by State and local laws covering boilers and other pressure vessels.

Many large boilers are assembled in manufacturing plants and shipped as complete units. Boilermakers often perform this assembly work, using the same skills for plant work as for field work.

Boilermakers use a variety of tools and equipment in their work. They cut and shape metal plate to size with power shears, power rolls, power presses, or oxyacetylene torches. They also use welding or riveting equipment. When assembling and erecting steel plate units at a construction site, they may use rigging equipment such as hoists, jacks, and rollers.



Layout Men (D.O.T. 809.381 and .781). Metals used in the manufacture of boilers, tanks, vats, and other pressure vessels initially are prepared for fabricating operations by layout men. These workers mark curves, lines, points, and dimensions on metal plates and tubes that serve as guides to other workers who cut or shape the parts required for fabrication of the pressure vessel. They lay out parts to scale as outlined on blueprints, sketches, or patterns. Layout men use compasses, dividers, scales, surface gages, hammers, and scribers in their work.

Fitup Men (D.O.T. 819.781). Before the various parts of boilers, tanks, vats, and other pressure vessels finally are assembled, fitup men temporarily assemble and fit them together in the shop. They bolt or tack-weld parts together and correct irregularities. Fitup men also fit together nozzles, pipes, fittings, and other parts.

Fitup men read and interpret blueprints and drawings used in the manufacturing process, check parts for accuracy, and make certain the parts meet specifications. They use handtools such as hammers, sledges, wrenches, and punches, and equipment such as welding machines, portable drills, and grinding tools.

Places of Employment

More than 25,000 boilermakers, layout men, and fitup men were employed in 1970. Several thousand were employed in the construction industry, mainly to assemble and erect boilers and other pressure vessels. Boilermakers also were employed in the maintenance and repair departments of industries such as iron and steel manufacturing, petroleum refining, railroad transportation, and electric and gas utilities. Large numbers worked in Federal Government installations, principally in Navy shipyards and Federal powerplants. Layout men and fitup men were employed mainly in plants that fabricate fire-tube and water-tube boilers, heat exchangers, heavy tanks, and similar boiler-shop products.

Boilermakers are employed in every State because of the widespread need for their skills in repair and installation work. Large numbers are employed in the Middle Atlantic and East North Central regions where metalworking industries are concentrated. Most layout men and fitup men also work in these two regions. Pennsylvania, California, Texas, Illinois, Ohio, New York, and New Jersey are among the leading States in the employment of boilermaking craftsmen.

Training, Other Qualifications, and Advancement

Many men have become boilermakers by working for several years as helpers to experienced boilermakers, but most training authorities agree that a 4-year apprenticeship is the best way to learn this trade. In the apprenticeship program, the apprentice works under the close supervision of a journeyman boilermaker who instructs him in the skills of the craft, including the proper way to use the tools and machines of the trade. Apprenticeship programs usually provide about 8,000 hours of relatively continuous employment and training, supplemented by about 600 hours of related technical instruction. Some of the technical subjects studied are blueprint reading, shop mathematics, welding techniques, and shop metallurgical science covering stress and strain of metals.

Many layout men and fitup men acquired their skills on the job. They usually are hired as helpers and learn the craft by working with experienced men. It generally takes at least 2 years to qualify as an experienced layout or fitup man in a fabricating shop where boilers and other pressure vessels are mass-produced. Shops which custom-make products generally hire qualified boilermakers for layout and fitup jobs.

When hiring apprentices or helpers most employers prefer high school graduates. Prior training in mathematics, blueprint reading, and shopwork is helpful to young men interested in becoming boilermakers, layout men, or fitup men. Most firms require prospective employees to pass a physical examination because good health and the capacity to do heavy work are necessary in these occupations. Mechanical aptitude and manual dexterity also are important qualifications.

Some boilermakers may become foremen for contractors specializing in boiler installation and repair work. A few may go into business for themselves.

Employment Outlook

Employment in boilermaking occupations is expected to increase slowly through the 1970's. Most openings will arise from the need to replace experienced workers who retire, die, or transfer to other fields of work.

Employment is expected to increase mainly because of the expansion of industries that use boiler products—particularly electric and gas utilities, chemical, petroleum, steel, and shipbuilding industries. In addition to increased demand for boiler products, the trend to erect large, complex, custom-made boilers on the construction site is expected to spur employment of skilled boilermakers. The development of atomic energy facilities may create a need for more boilermakers, layout men, and fitup men, either to manufacture or install boilers and related products. In shops that fabricate boiler products, however, growth in the number of boilermakers, layout men, and fitup men is expected to be limited by the increasing use of more efficient production techniques and equipment, including improved materials handling methods and welding equipment.

Earnings and Working Conditions

Wage rates of skilled boilermaking workers compare favorably with those of other craftsmen, although wages vary widely because of differences in factors such as the experience and skill of the worker, the kind of industry in which he is employed, and the geographical region in which he works.

Boilermakers in field assembly and installation (construction) work generally receive higher hourly wage rates than boilermakers, layout men, and fitup men employed in industrial plants, although they may not be employed as steadily. According to a national survey of building trades workers in the construction industry, union minimum hourly wage rates for boilermakers in 68 large cities averaged $6.48 on July 1, 1970. Straight-time hourly earnings for boilermakers in 15 of the cities, selected to show wage information from various areas of the country, appear in the accompanying tabulation.

City	*Rate per hour*
Baltimore	$6.90
Boston	6.25
Buffalo	7.34
Chicago	7.60
Cleveland	7.96
Denver	5.85
Fresno	6.80
Houston	6.00
Kansas City	5.85
Los Angeles	6.80
Memphis	5.35
New Orleans	6.00
New York	8.68
Phoenix	6.80
Seattle	6.30

Comparable data were not available covering boilermakers employed in industrial plants. However, information on minimum hourly wage rates was available from union-management agreements, in effect in 1970, covering a large number of boilermakers, layout men, and fitup men employed in fabricated plate work, petroleum, and shipbuilding industries. The majority of these agreements called for minimum hourly wage rates ranging from about $3.30 to $5.60. Generally, layout men received higher rates than boilermakers, and boilermakers received higher rates than fitup men.

Boilermakers, layout men, and fitup men in industrial plants usually work the same number of weekly hours as other plant workers, generally 40 hours. Most union-management agreements covering these workers provide fringe benefits such as hospitalization, and medical and surgical insurance; paid vacations; life insurance; sickness and accident insurance; and retirement pensions.

When engaged in boiler repair and assembly work, boilermakers often are required to work in cramped quarters or at great heights. Some work also must be done under conditions of dampness, heat, and poor ventilation.

Boilermaking is more hazardous than many other metalworking occupations. Employers and unions attempt to eliminate injuries in boilershops by promoting safety training and the use of protective equipment, such as safety glasses and metal helmets.

Most boilermakers, layout men, and fitup men belong to labor unions. The principal union in these trades is the International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers. Some boilermaking craftsmen are members of industrial unions, such as the Industrial Union of

Marine and Shipbuilding Workers of America; the Oil, Chemical and Atomic Workers International Union; and the United Steelworkers of America.

Sources of Additional Information

General information about the work of boilermakers may be obtained from:

International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers, Eighth at State Ave., Kansas City, Kansas 66101.

DISPENSING OPTICIANS AND OPTICAL MECHANICS

(D.O.T. 713.251, .381, .884, and 299.884)

Nature of the Work

Dispensing opticians and optical mechanics (also called optical laboratory technicians) make and fit eyeglasses prescribed by physicians and optometrists to correct defective vision. Optical mechanics grind and polish lenses to the specifications of prescriptions and assemble lenses in frames. Dispensing opticians then fit and adjust the finished glasses to the customer's facial features. In some States, dispensing opticians also fit contact lenses. Occasionally, both the fabricating and fitting of glasses are performed by the same person.

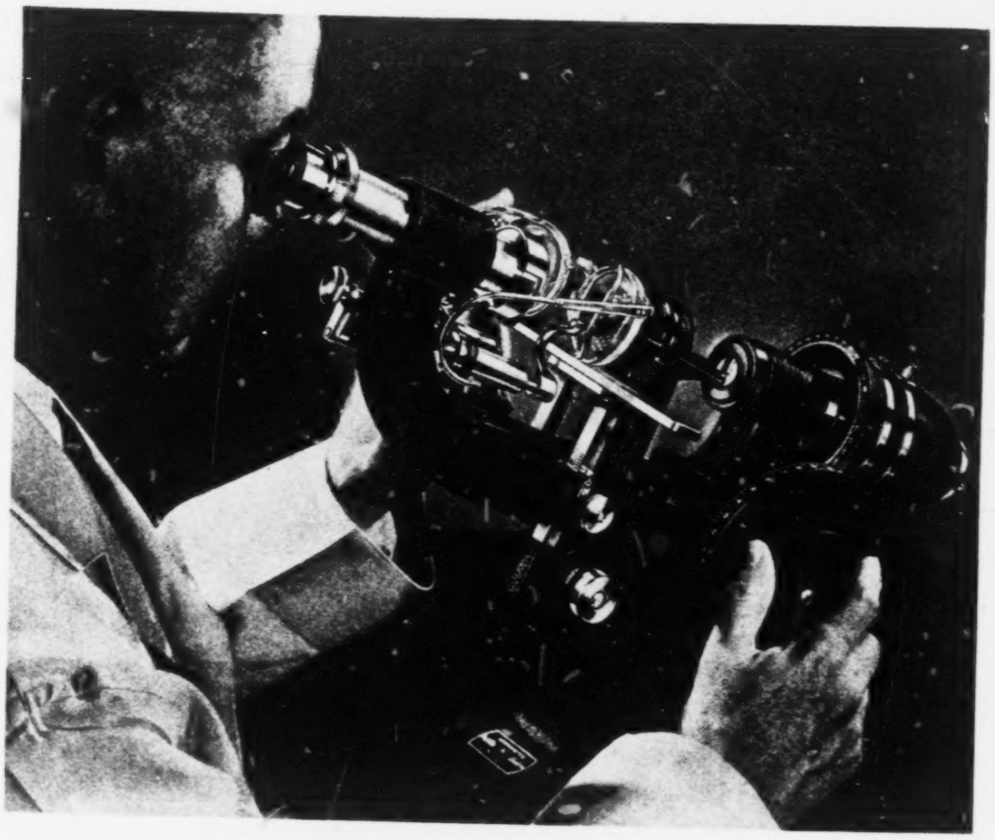
The *dispensing optician* works in a retail optical establishment. He makes certain that the glasses follow the prescription and fit the customer properly. The optician determines exactly where the lenses should be placed in relation to the pupils of the eyes by measuring the distance between the centers of the pupils. He also assists the customer in selecting the proper eyeglass frame by measuring the customer's facial features and giving consideration to the various styles and colors of frames.

Before prescription eyeglasses are fitted, the dispensing optician prepares a work order which gives the optical mechanic the information he needs to interpret the prescription properly, grind the lenses, and insert them in a frame. The work order consists of the lens prescription; information on the size, tint (where appropriate), optical centering of the lens, and other optical requirements; and the size, color, style, and shape of the frame. After the eyeglasses are made, the optician adjusts the frame to the contours of the customer's face and head to make sure they fit properly and comfortably. He uses small handtools, such as optical pliers, files, and screwdrivers, and also uses a precision instrument to check the power and surface quality of the lenses. In some shops, he may do lens grinding and finishing, and sell other optical goods such as binoculars, magnifying glasses, and nonprescription sunglasses.

In fitting contact lenses, the dispensing optician, following the physician's or optometrist's prescription, measures the cornea of the customer's eye and then prepares specifications to be followed by a firm specializing in finishing such lenses. The dispensing optician uses precision instruments to measure the power and curvature of the lenses and the curvature of the cornea of the eye. Contact lens fitting requires considerably more skill, care, and patience than conventional eyeglass fitting. The dispensing optician instructs the customers in the insertion, removal, and care of the contact lenses during the initial period of adjustment, which may last several weeks. The physician or optometrist rechecks their fit, as needed. If minor adjustments are necessary, the dispensing optician makes them; if major changes are needed, he returns the lenses to the contact lens manufacturer.

Optical mechanics make prescription eyeglasses but not contact lenses. The two types of optical mechanics are *surfacer* (or prescription lens grinder) and *benchman* (or finisher). Starting with standard or stock size lens blanks, which large optical firms mass-produce, the surfacer lays out the work and grinds and polishes the lens surfaces. He uses precision instruments to measure the lenses and assure that they fit the prescription. In small laboratories, one man may do these operations and benchwork too. In large laboratories, work is divided into separate operations which are performed mainly by workers who operate power grinding and polishing machines.

The benchman marks and cuts the lenses and smooths their edges so that they will fit the frame. He then assembles the lenses and frame parts into finished eyeglasses. In large laboratories, these duties are divided into several operations which are performed mainly by semiskilled workers. The benchman uses small handtools, such as lens cutters, chippers, pliers, files, protractors, and diamond point glass drills. He also uses an automatic edging machine for shaping lens edges and precision instruments to detect any imperfections.



Places of Employment

An estimated 11,000 dispensing opticians and 15,000 optical mechanics were employed throughout the country in 1970. A few thousand women are employed in these trades—most as dispensing opticians.

Most dispensing opticians were employed by retail optical shops or the optical departments of department stores and other retail establishments. Many also worked for eye physicians or optometrists who sell eyeglasses directly to patients. A small number of dispensing opticians worked in prescription departments of wholesale optical laboratories that did work for retail optical firms; in special prescription shops in large ophthalmic goods factories; and in hospitals.

Most optical mechanics worked in wholesale optical laboratories. The remainder worked for the same types of employers as did dispensing opticians.

In addition to the dispensing opticians and optical mechanics mentioned above, many others are proprietors of retail optical establishments.

Although opticians and mechanics are found in all States, more than half are located in the following States: New York, Massachusetts, Pennsylvania, California, Texas, Illinois, Ohio, Michigan, and New Jersey.

Training, Other Qualifications, and Advancement

Most optical mechanics and dispensing opticians learn their skills through informal, on-the-job training. On-the-job training in dispensing work may last several years and usually includes instruction in optical mathematics, optical physics, the use of precision measuring instruments, and other related subjects.

Trainees start in jobs requiring simple skill and dexterity and gradually work into the more difficult jobs. For example, they may begin by processing lenses through a lens grinding machine. After they have become skilled in this operation, the trainees perform other production operations such as polishing, edging, lens cutting, and eyeglass assembly. Their training may include instruction in the measurement and curvature of lens surfaces, the measurement of lenses, and other subjects related to their work. When the trainees have acquired experience in all types of eyeglass production work, which usually takes about 3 years, they are considered all-round optical mechanics. Some trainees become specialists on one type of work performed by optical mechanics, such as surfacing or bench work. The training time required to become a specialist generally is less than that needed to become an all-round mechanic.

High school graduates also can prepare for both optical dispensing and mechanical work through formal apprenticeship programs. Some optical firms have 4- or 5-year apprenticeship programs. Apprentices having exceptional ability may complete their training in a shorter period. Most training authorities agree that optical mechanics and dispensing opticians who learn as apprentices have more job opportunities, improved job security, and more opportunities for advancement than those without such training.

Formal institutional training for the dispensing optician is becoming increasingly common In 1970, seven schools offered 2-year full-time courses in optical fabricating and dispensing work leading to an associate degree. In addition, a number of vocational schools offered full-time courses lasting 9 months in optical mechanics. Graduates from such schools often go to work for retail optical stores where they receive additional on-the-job training. Large manufacturers of contact lenses offer nondegree courses of instruction in contact lens fitting that usually last a few weeks. A small number of dispensing opticians and optical mechanics learn their trades in the Armed Forces.

Employers prefer applicants for entry jobs as dispensing opticians and optical mechanics to be high school graduates who have had courses in the basic sciences. A knowledge of physics, algebra, geometry, and mechanical drawing is particularly valuable. Interest in, and ability to do, precision work are essential. Because dispensing opticians deal directly with the public, they must be tactful and have a pleasing personality.

In 1970, 17 States had licensing requirements governing dispensing opticians: Arizona, California, Connecticut, Florida, Georgia, Hawaii, Kentucky, Massachusetts, Nevada, New Jersey, New York, North Carolina, Rhode Island, South Carolina, Tennessee, Virginia, and Washington. Some of these States also require licenses for optical mechanics in retail optical shops or for the retail optical shop itself. Some States permit dispensing opticians to fit contact lenses whereas others prohibit them from doing so. To obtain a license, the applicant generally must meet certain minimum standards of education and training and also pass a written or practical examination, or both. For specific requirements, the licensing boards of individual States should be consulted.

Optical mechanics can become supervisors, foremen, and managers. Many of them have become dispensing opticians, although there is a trend to train specifically for dispensing optician jobs. There are opportunities for workers in both occupations to go into business for themselves, especially for those having all-round training in both shop and dispensing work. Dispensing opticians also may become managers of retail optical stores. Some dispensing opticians may become salesmen for wholesale optical goods companies or for manufacturers of conventional eyeglasses or contact lenses.

Employment Outlook

Employment of dispensing opticians is expected to increase moderately through the 1970's. In addition to the opportunities resulting from employment growth, a few hundred job openings will result annually from the need to replace experienced workers who retire or die. Some additional job openings will become available as workers transfer to other occupations.

Little or no change in the number of optical mechanics is expected during the 1970's. Several hundred job openings, however, will be available annually because of the need to replace experienced mechanics who retire, die, or transfer to other occupations.

The production of prescription lenses is expected to increase considerably during the period. Factors that will contribute to this growth include the increasing size, and the rising literacy and educational level of the population; a large increase in the number of older persons (a group most likely to need eyeglasses); and the growing emphasis on good vision (more than half the population over 6 years of age now wear eyeglasses). In addition, the many different styles and colors of eyeglass frames now available have increased the number of pairs of eyeglasses purchased by individuals and encouraged the wearing of eyeglasses.

The increase in production of prescription lenses will result in the growing employment of dispensing opticians. However, principally as a result of more efficient methods of production and improved equipment, employment of optical mechanics is not expected to increase.

Earnings and Working Conditions

In 1970, information from a small number of union-management contracts indicated that optical laboratory mechanics earned from $2.50 to $4.25 an hour. Depending on experience, skill, and responsibilities, foremen earned up to 20 percent more than mechanics.

Dispensing opticians usually earn about 15 to 25 percent more than optical mechanics. Opticians who own their business may earn much more.

Apprentices start at about 60 percent of the skilled worker's rate; their wages are increased periodically so that upon completion of the apprenticeship program, they receive the beginning rate for journeymen.

Optical laboratory mechanics at wholesale establishments usually have a 5-day, 40-hour week. Dispensing opticians and mechanics at retail shops generally work a 5½- or 6-day week. Employment is year round because demand for glasses fluctuates little.

Surroundings of the dispensing optician are pleasant, well-lighted, and well-ventilated, but noisy because of the power-grinding and polishing machines.

Physically handicapped persons who have full use of their eyes and hands can perform some of the more specialized jobs in the larger laboratories.

Some optical mechanics and dispensing opticians are members of unions. Most of them are members of the International Union of Electrical, Radio and Machine Workers.

Sources of Additional Information

A list of schools offering courses in opticianry may be obtained from:

Guild of Prescription Opticians of America, 1250 Connecticut Ave., NW., Washington, D.C. 20036

General information may be obtained from the following sources:

American Board of Opticianry, 821 Eggert Rd., Buffalo, N.Y. 14226

International Union of Electrical, Radio and Machine Workers, 1126 16th St., NW., Washington D.C. 20036

Optical Wholesalers Association, 222 West Adams St., Chicago, Ill. 60606

ELECTROPLATERS

(D.O.T. 500.380, .782, and .884)

Nature of the Work

Electroplaters use plating solutions and electric current (electrolysis) to coat metal and plastic articles with chromium, nickel, silver, gold, or other metal to give the articles a protective surface or a more attractive appearance. Products that often are electroplated include items as widely different as automobile bumpers, silverware, costume jewelry, electrical appliances, and jet engine parts. A process known as electroforming forms items such as spray paint masks, search light reflectors, and a variety of molds used in the manufacture of plastic items.

Skills vary among plating shops. All-round platers in small shops analyze solutions, do a great variety of small lot plating, calculate the time and current needed for various types of plating and perform other technical duties. They also may order chemical and other supplies for their work. Platers in production shops usually carry out less difficult, more specialized assignments requiring limited technical knowledge.

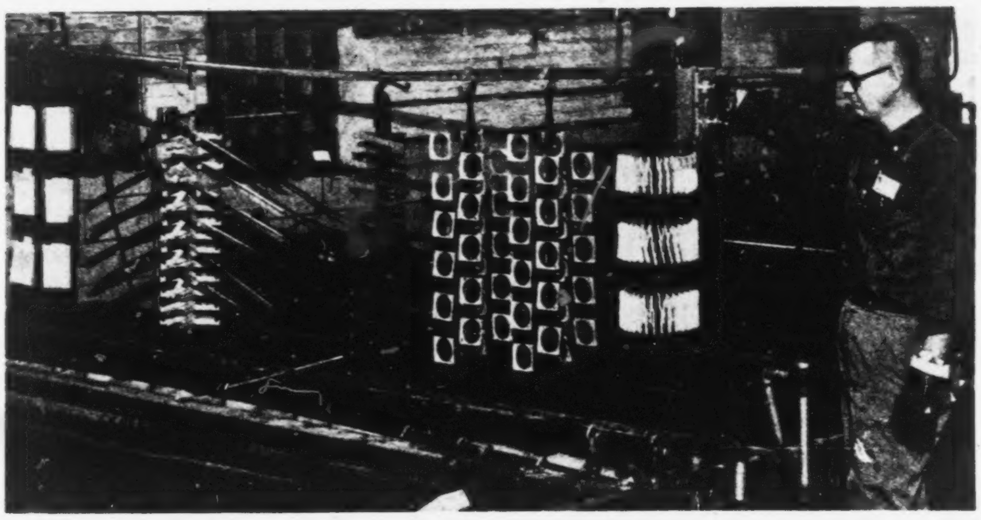
Parts of an item not to be electroplated are covered with lacquer, rubber or tape. The item is then scoured or dipped in a cleansing bath before being placed in the plating solution. The article may be removed from the solution at intervals to make sure the work is progressing satisfactorily. Unnoticed errors can be costly.

Many types of plating must be inspected for visible defects. Micrometers, calipers, and electronic devices are used to determine the quality of the work. Helpers frequently place objects on racks before plating, remove them afterwards, and then clean tanks and racks.

Places of Employment

An estimated 17,000 electroplaters were employed in 1970. About half of them worked in independent job shops and specialized in metal plating and polishing for manufacturing firms and for individuals. The remaining platers were employed in plants that manufactured plumbing fixtures, cooking utensils, wire products, electric appliances, electronic components, motor vehicles, mechanical measuring instruments, and other metal products.

Electroplaters are employed in almost every part of the country, although most work in the Northeast and Midwest near the centers of the



Electroplater prepares to immerse helicopter parts in nickel solution.

metalworking industry. Large numbers of electroplaters work in Los Angeles, San Francisco, Chicago, New York, Detroit, Cleveland, Providence and Newark (New Jersey).

Training, Other Qualifications, and Advancement

Most electroplaters learn the trade on the job as helpers by working with experienced platers. Three years or longer are required to become an all-round plater in this way. Platers employed in production shops who are not required to have an all-round knowledge of plating can learn their jobs in much less time. A small percentage of electroplaters have received all-round preparation by working 3 or 4 years as an apprentice.

The program for apprentices combines on-the-job training and related classroom instruction in the properties of metals, chemistry, and electricity as applied to plating. The apprentice does progressively more difficult work as his skill and knowledge increase. By the third or fourth year, he determines cleaning methods, does plating without supervision, makes solutions, examines plating results, and supervises helpers. Qualified journeymen may advance to foremen.

High school and vocational school courses in chemistry, electricity, physics, mathematics, and blueprint reading will prove valuable to young persons interested in becoming electroplaters. Some colleges, technical institutes, and vocational high schools offer 1- or 2-year courses in electroplating. In addition, many branches of the American Electroplaters Society conduct basic courses in electroplating.

Employment Outlook

Employment of electroplaters is expected to increase moderately through the 1970's. Most openings however, will result from the need to replace experienced workers who retire, die, or transfer to other occupations.

Expansion of metalworking industries and the electroplating of a broadening group of metals and plastics are expected to increase the need for electroplaters. However, continuing mechanization and the assigning of technical responsibilities to chemists and other personnel will limit growth of this occupation.

Earnings and Working Conditions

National wage data are not available for electroplaters. However, data obtained from nearly 60 firms in two large cities indicated that most experienced electroplaters had hourly wage rates ranging from $2 to $4 in late 1970. Some highly skilled platers earned more than $4.50 an hour. During apprenticeship or on-the-job training, a worker's wage rate starts at about 60 to 70 percent of an experienced worker's rate and progresses to the full rate by the end of his training period. Almost all plants pay shift premiums for night work. Many employers provide paid holidays and vacations and pay part or all of additional benefits such as life, health, and accident insurance.

Plating work involves some hazards because acid, alkaline, or poisonous solutions are used. Humidity and odor also are problems in electroplating plants. However, most plants have installed systems of ventilation and other safety devices which have considerably reduced the occupational hazards. Protective clothing and boots provide additional protection. Mechanical devices generally are used to handle most of the lifting required, but at times the worker must lift and carry objects weighing up to 100 pounds.

Some platers are members of the Metal Polishers, Buffers, Platers and Helpers International Union. Other platers have been organized by the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America, and the International Association of Machinists and Aerospace Workers. Some of the labor-management contracts covering electroplating provide health insurance and other benefits.

Sources of Additional Information

For educational information concerning electroplating and other metal finishing methods, write to:

American Electroplaters Society, Inc., 56 Melmore Gardens, East Orange, N.J. 07017.

For information on job opportunities, training, and other questions, write to:

National Association of Metal Finishers, 248 Lorraine Ave., Upper Montclair, N.J. 07043.

FURNITURE UPHOLSTERERS

(D.O.T. 780.381)

Nature of the Work

Furniture upholsterers recondition sofas, chairs, and other upholstered furniture. These craftsmen repair or replace fabrics, springs, webbing, frames, and other parts that are worn or damaged. (Workers employed in the manufacture of upholstered furniture are not included in this statement.)

The upholsterer usually places the furniture on padded wooden horses so that he may work at a convenient level. Using a tack puller or chisel and mallet, he pulls out the tacks that hold the fabric in place and removes the fabric. He also may remove padding and burlap that cover the springs. He examines the springs and removes the broken or bent ones. If the webbing that holds the springs in place is worn, all of the springs and the webbing are removed. The upholsterer then repairs the frame by regluing loose sections and refinishing wooden arms.

To reupholster the furniture, the upholsterer first tacks strips of webbing to the frames. Next, he sews new springs to the webbing and ties each spring to the adjoining ones, securing the outside springs to the frame. He then uses burlap, filling, and padding to cover the springs, and sews the padding to the burlap. Finally, after covering the padding with muslin and new fabric, he attaches these materials to the frame and makes sure that they are smooth and tight. He completes the job by sewing or tacking on fringe, buttons, or other ornaments ordered by the customer.

Upholsterers use a variety of handtools in their work, including tack and staple removers, pliers, hammers, and shears. They also use special tools such as webbing stretchers and upholstery needles. Upholsterers who work in small shops lay out patterns and use hand shears or machines to cut the upholstery fabric. They also operate sewing machines to form new upholstery covers. In large shops, however, seamstresses usually perform these tasks. Sometimes upholsterers pick up and deliver furniture. Those who own shops order supplies and equipment, keep business records, and perform other managerial and administrative tasks.

Places of Employment

More than one-half of the estimated 33,000 furniture upholsterers

employed in 1970 worked in small upholstery shops. Most of these shops had fewer than eight employees. Many upholsterers also were employed by furniture stores, and a few worked for organizations —movie theatres, hotels, motels, and others—that maintain their own furniture.

Employment of upholsterers is distributed geographically in much the same way as the Nation's population. Thus, they are employed mainly in major metropolitan areas and in the more populated States.

Training, Other Qualifications, and Advancement

The most common way to learn this trade is through on-the-job training in an upholstery shop. Prospective upholsterers are hired as helpers to perform simple jobs, such as removing old fabric, padding, and springs. As they gain experience, they perform more complex tasks, such as installing webbing and springs, and sewing on fabric and trimming. A helper may become a skilled upholsterer after about 3 years of on-the-job training.

Inexperienced persons can learn many skills of the trade by working in furniture factories and performing a variety of jobs closely related to furniture upholstering. They also may get valuable training in vocational or high school courses that include chair caning, furniture making, textile fabrics, and upholstery repair. However, additional training and experience in a shop usually is required before these workers can qualify as skilled upholsterers. A few people learn the trade through formal apprenticeship programs that last from 3 to 4 years and include classroom instruction.

Young persons interested in becoming upholsterers should have good manual dexterity and be able to do occasional heavy lifting. An eye for detail, ability to distinguish between colors, and a flair for creative work are helpful.

Upholsterers usually purchase their handtools, but employers provide power tools.

Many upholsterers open their own shops. Almost one out of every three upholsterers is self-employed —a much higher proportion than in most trades.

Employment Outlook

Employment of upholsterers is expected to show little or no change through the 1970's. Several hundred job openings, however, will arise each year because of the need to replace experienced workers who retire, die, or transfer to other occupations. There have been many unfilled job openings in recent years because the supply of qualified upholsterers has been insufficient to meet the demand.

Among the factors tending to increase requirements for furniture upholsterers are growing expenditures for furniture, growth in the number of families, and higher levels of personal income. However, these factors will be offset by the rising cost of reupholstering furniture relative to replacing it.

Earnings and Working Conditions

Earnings data for furniture upholsterers are not available on a national basis. However, information from union-management contracts covering many of these workers in 1970 indicated that hourly rates for helpers ranged from $1.60 to $2.50, and for experienced upholsterers from about $3.00 to $5.25. A few upholsterers were paid on a piecework basis. Hourly rates depended on factors such as skill level, length of time employed, and geographic location. Hourly rates in the South were generally lower than those in the North and West.

Upholsterers generally work 40 hours a week, although overtime is common during the weeks before major holidays. Many upholsterers receive paid vacations and sick leave, and some are covered by health insurance plans.

Many upholstery shops are spacious, adequately lighted, and well ventilated and heated. However, dust from padding and stuffing sometimes is present. Upholsterers stand while they work and do a considerable amount of stooping and bending. The work generally is safe, although minor cuts from sharp tools and back strain from lifting and moving heavy furniture are not uncommon.

Sources of Additional Information

For further information on work opportunities for upholsterers, contact local employers or the local office of the State employment service. General information on upholsterers may be obtained from:

Upholsterers International Union of North America, 1500 North Broad St., Philadelphia, Pa. 19121.

GASOLINE SERVICE STATION ATTENDANTS

(D.O.T. 915.867)

Nature of the Work

Almost all the 110 million motor vehicles in the United States are serviced at one time or another by gasoline service station attendants (also called gasoline station salesmen or servicemen).

In servicing a car, the attendant pumps gasoline, cleans the windshield, and offers the additional services of checking water level in the radiator and battery, oil level in the crankcase and automatic transmission, and air pressure in the tires. He also may check the tires, fan belt, and other parts of the car for excessive wear. The attendant may perform a variety of other services for the customer, ranging from giving street directions to making minor repairs.

The attendant has other responsibilities besides servicing cars. He sells and installs parts and accessories such as tires, batteries, fan belts, and windshield wiper blades. When a customer pays his bill, he either makes change, or prepares a charge slip if the customer uses a credit card. In small stations, particularly, he may perform minor maintenance and repair work, such as lubrication, changing engine oil, rotating tires, repairing tires, or replacing a muffler. Some attendants, called mechanic-attendants, perform more difficult repairs.

The attendant also may keep the service areas, building, and restrooms clean and neat. In some stations, he helps the station manager take inventory, set up displays, and perform other duties associated with the operation of a small business.

If a gasoline service station provides emergency road service, the attendant occasionally may drive a tow truck to a stalled car and change a flat tire or perform other minor repairs. If more extensive repairs are needed, he tows the customer's vehicle back to the service station.

In doing maintenance and repair work, gasoline service station attendants may use simple handtools such as screwdrivers, pliers, and wrenches, and power tools such as pneumatic wrenches. Mechanic-attendants frequently use more complex equipment such as motor analyzers and wheel alignment machines.

Places of Employment

An estimated 410,000 service station attendants, more than one-third of whom were part-time workers, were employed in gasoline service stations in 1970. In addition to attendants, more than 225,000 gasoline service station managers and owners did similar work.

Gasoline service station attendants are employed in every section of the country, in the largest cities, the smallest towns, and outlying areas. About half of them, however, are employed in the nine States that have the largest number of motor vehicles: California, Texas, New York, Ohio, Pennsylvania, Illinois, Michigan, Florida, and New Jersey.

Training, Other Qualifications, and Advancement

An applicant for a job as gasoline service station attendant should have a driver's license, a general understanding of how an automobile works, and some sales ability. He should be friendly and able to speak well, present a generally neat appearance, and have self-confidence. He should know simple arithmetic so that he can make change quickly and accurately and help keep business records. An applicant should be familiar with local roads, highways, and points of interest in order to give directions to strangers and to locate vehicles whose owners have called for road service.

Although completion of high school is not generally a requirement for getting an entry job, it is an advantage because it indicates to many employers that a young man can "finish a job." A high school education generally is required for attendants to qualify for service station management training programs conducted by oil companies, and to advance to the position of service station manager.

Gasoline service station attendants usually are trained on the job, although there are some formal training programs. Attendants who are trained on the job do relatively simple work at first, such as cleaning the station, washing cars, pumping gas, and cleaning windshields. Gradually, they progress to more advanced work such as making sales, writing credit charge slips, doing simple maintenance work, installing accessories on cars, and helping to keep the station records. It usually takes from several months to a year for a gasoline service station attendant to become fully qualified.

Formal training programs for young people who want to do gasoline service station work are offered in many high schools around the country. In this curriculum, known as distributive education, students in their last 2 years of high school take business education courses and work part-time in a gasoline service station where they receive instruction and supervision in all phases of service station work.

Some attendants are enrolled in formal training programs for service station managers, which are conducted by most major oil companies. These programs usually last from 2 to 8 weeks and emphasize subjects such as simple automobile maintenance, salesmanship, and business management.

Several avenues of advancement are open to gasoline service station attendants. Additional training qualifies attendants to become automobile mechanics; those having business management capabilities may advance to station manager. Many experienced station managers and automobile mechanics go into business for themselves by leasing a station from an oil company, the most common means, or by buying their own service station. Some service station managers are hired by oil companies as salesmen or district managers.

Employment Outlook

Employment of gasoline service station attendants is expected to increase moderately through the 1970's. In addition to the full-time and part-time job openings resulting from employment growth, thousands of openings are expected each year from the need to replace attendants who retire, die, or transfer to other occupations.

Employment of service station attendants is expected to increase as a result of the growing consumption of gasoline and other service station products. The number of motor vehicles is expected to rise because of growing population, income, multiple car ownership, and the continuing movement to the suburbs. Also, greater use of cars is expected as families have more leisure time and as the highway systems continue to be improved.

More attendants also may be needed to perform additional maintenance on newer, more complex cars. For example, more cars will have devices that reduce exhaust fumes, and these devices must be serviced periodically. On the other hand, more cars that require oil changes and lubrication less frequently will offset partially the servicing requirements of additional, more complex vehicles.

Earnings and Working Conditions

Hourly earnings of gasoline service station attendants vary considerably. Hourly earnings for many attendants ranged from $1.80 to $2.91 in 1970, according to wage data collected from a small number of major oil companies. Attendants employed in large metropolitan areas generally had higher earnings than those employed in small towns.

In many stations, employers provide fringe benefits such as accident and health insurance and paid vacations. Some employers furnish uniforms and pay for their cleaning; others require the attendants to pay for these expenses. More than one-half of the attendants work over 40 hours a week; many work more than 48 hours. Attendants frequently work at night and on weekends and holidays.

A gasoline service station attendant works outdoors in all kinds of weather. He must be in good physical condition because he does considerable lifting and stooping and spends much time on his feet. Possible injuries include cuts from sharp tools and burns from hot engines. The attendant frequently gets dirty because he pumps gasoline and works around oil and grease. For many attendants, however, the opportunity to deal with people and the possibility of someday managing their own service stations more than offset these disadvantages. For others, the opportunity to get part-time employment is important.

Some high school and college students have been able to work their way through school by working as gasoline service station attendants after school, and on vacations and holidays. Some workers also supplement their income from regular jobs by working part-time as attendants.

Sources of Additional Information

For further information regarding work opportunities for gasoline service station attendants, inquiries should be directed to local gasoline service stations or the local office of the State employment service.

INSPECTORS (MANUFACTURING)

Nature of the Work

Almost everything manufactured, including the products we eat, drink, wear, or ride in, must be carefully checked by inspectors during the manufacturing process. The millions of automobiles, television sets, business machines, and other mass-produced items must be inspected to make sure they operate properly. In addition, inspectors check the quality of the raw materials and parts that make up finished goods.

Inspectors use a variety of methods to make certain that products meet specifications. They may merely look for scratches and other defects; or they may use gauges, micrometers, and other devices to examine parts and materials. They may read work orders, and do arithmetic involving decimals and fractions when reading measuring instruments.

Skilled inspectors work under general supervision whereas semiskilled inspectors usually work under close supervision. Skilled inspectors generally have greater discretion in accepting or rejecting products and are responsible for inspecting the most critical parts of mass-produced goods. Skilled inspectors also use a much wider variety of testing instruments. In the metal-working industries, they read blueprints and interpret complex specifications.

Inspectors often keep records of the number of parts they have rejected. When they find too many faulty pieces, they notify their supervisors so that corrections can be made on the production line. Inspectors may use hand-tools, such as screwdrivers or pliers. In some industries, inspectors make minor repairs and adjustments and grade products for quality.

Places of Employment

In 1970, most of the approximately 665,000 inspectors—largely semiskilled—worked in plants that produced durable goods such as electrical and nonelectrical machinery, fabricated metal products, transportation equipment, and aerospace products. Others were employed in plants that produced non-durable goods such as chemicals, textiles, apparel, and food products. Large numbers of inspectors were employed in Ohio, New York, Michigan, Illinois, Pennsylvania, California, and New Jersey.

More than two-fifths of all inspectors were women. Many of these women were employed in the food, textile, and apparel industries. Others were employed throughout the metalworking industries, especially in plants that produce small electrical and electronic components.

Training, Other Qualifications, and Advancement

Inspectors generally are trained on the job for a brief period—from a few hours or days to several months, depending upon the skill required.

Employers look for applicants who have good health and eyesight, can follow directions, and can concentrate on details. A few large companies give aptitude tests; for example, in the electronics industry, new workers may be given tests to determine their ability to work with numbers. Employers may hire applicants who do not have a high school diploma but have qualifying aptitudes or related experience. Some employers prefer experienced production workers for inspection jobs.

Some semiskilled inspectors in the metal products industries who

Inspector checks fluorescent light tubing.

take educational courses, such as blueprint reading and shop mathematics, may advance to skilled inspectors or quality control technicians. After acquiring sufficient experience and knowledge, a few become foremen.

Employment Outlook

Employment of inspectors is expected to increase moderately through the 1970's. However, most openings will result as workers retire, die, or transfer to other occupations, and as women leave their jobs to marry or rear a family. Overall, many thousands of openings for inspectors will be created each year.

Most of the industries that employ these workers, especially the electrical machinery industry, are expected to increase their employment in the long run. The growing complexity of manufactured products should also result in a need for more inspectors. However, increasing use of mechanized and automatic inspection equipment will partially offset these factors.

Earnings and Working Conditions

National wage data on inspectors are not available. However, information from a limited number of union-management contracts indicate that hourly rates for inspectors ranged from $1.95 to $4.85 in 1970, depending on skill level, type of product inspected, geographic area, and industry.

Working conditions vary considerably for inspectors. For example, some have well-lighted, air-conditioned workplaces in an aircraft or missile plant; others, who work on the production floor of a machinery or metal fabricating plant, often are exposed to high temperatures, oil, grease, and noise.

Many inspectors are members of labor unions, among which are the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Association of Machinists and Aerospace Workers; the International Union of Electrical, Radio and Machine Workers; and the International Brotherhood of Electrical Workers. Most labor-management contracts provide for fringe benefits such as paid holidays and vacations, health insurance, life insurance, and retirement pensions.

Sources of Additional Information

Additional information about employment opportunities in this field may be available from local offices of the State employment service.

JEWELERS AND JEWELRY REPAIRMEN

(D.O.T. 700.281 and .381)

Nature of the Work

Jewelers are skilled craftsmen who make or repair rings, pins, necklaces, bracelets, and other precious jewelry. They create jewelry from metal such as gold, silver, and platinum, and set precious or semiprecious stones. To repair jewelry, they solder broken parts, make new parts, enlarge or reduce the size of rings, reset stones, and restyle old jewelry. The jewelers' work is very delicate and must be done with care and precision, as the materials used usually are expensive. An eye "loupe," or magnifying glass held over the eye, often is used when working to close tolerances. To make jewelry, jewelers may follow their own design or one prepared by a design specialist. The metal is formed to follow the design in one of several ways. For example, work may involve shaping metal stock with hand and machine tools or melting and casting metal in a mold. When jewelry is produced in volume, the metal usually is formed either by the casting or the stamping process.

Shaping metal stock by hand may involve the following metalworking operations: outlining, cutting, drilling, sawing, filing, shaping, engraving, and electroplating. Individual parts are polished and then joined by soldering. After the article has been assembled, surface decorations are made and jewels or stones are mounted. When jewelry is made in this manner, tools such as files, saws, and drills; dapping, carving, and chasing tools; jewelers' lathes; soldering irons; and polishing machines are used.

To cast gold and platinum jewelry, a model is made by a jewelry modelmaker, a craftsman who has a thorough knowledge of the casting process. A rubber mold is produced from the model and into this mold wax or plastic is injected under pressure. The pattern produced is placed in a plasterlike material and burned out, leaving a cavity in the material. The precious metal then is cast into this cavity by centrifugal force. After cooling, the cast piece is removed. Articles produced by the process require a minimum of finishing. Jewels or stones then may be set in the cast piece and it may be engraved.

Cast costume jewelry is produced

similarly, except that the metal is cast directly into a rubber or metal mold, and either tumbled and plated or finished on a polishing machine.

In the stamping process, which is used to make costume and some precious jewelry, the metal piece is formed in a stamping machine that brings together, under tremendous force, a die and metal from which the piece is to be made. The die has a cavity shaped to the exact contour and dimension of the desired article.

As a rule, jewelers specialize in making a particular kind of jewelry, or in a particular operation, such as making models and tools, engraving, polishing, or setting diamonds and other stones. After years of experience, some become all-round jewelers capable of making and repairing any kind of jewelry. Costume jewelry and some kinds of precious jewelry are mass produced by factory workers using assembly line methods; however, skilled jewelers are needed to make the models and tools for this large-scale production. Skilled jewelers also may perform finishing operations, such as stone setting and engraving, on stamped or cast pieces.

Many jewelers make and repair jewelry in their own stores where they also may sell jewelry, watches, and other merchandise, and repair watches. Other jewelers operate trade shops that specialize in making jewelry and in doing repair work for jewelry stores owned or operated by merchants who are not jewelry craftsmen or who take in more repair work than they can handle.

Places of Employment

About half of the 15,000 jewelers and jewelry repairmen employed in 1970 were self-employed. Most of the self-employed owned either retail jewelry stores or repair shops. About half of those who were not self-employed worked in jewelry manufacturing establishments; others worked in retail jewelry stores.

Retail jewelry stores are located throughout the country. The heaviest concentration of these stores, as well as the small repair shops that service them, is located in large commercial centers, such as New York City, Chicago, Los Angeles, and San Francisco.

Nearly three-fourths of all precious jewelry manufacturing plants are located in New York, New Jersey, Rhode Island, and California. The New York City metropolitan area is the center of precious jewelry manufacturing.

Training, Other Qualifications, and Advancement

Young persons generally learn the jewelry trade either by serving a formal apprenticeship or through informal on-the-job training while working for an experienced jeweler. Jewelry repair, which usually is less complicated than jewelry making, can be learned in a short time by individuals already trained in filing, sawing, drilling, and other basic mechanical skills. Courses in jewelry repair are given in several trade schools. Other trade schools offer courses in specific types of jewelry work, such as diamond setting, jewelry design, and engraving.

Formal apprenticeship in this trade, depending on the type of training, takes from 3 to 4 years. For example, 3 years are required to become a colored-stone setter and 4 years to qualify as a diamond setter. Throughout the apprenticeship, training on the job is supplemented by trade school instruction in design, quality of precious stones, chemistry of metals, and other related subjects. Initial work assignments may be to set up work for soldering or to do simple soldering or rough polishing. As an apprentice gains experience, he advances to more difficult work. After completion of the apprenticeship, he becomes a qualified journeyman jeweler.

Jewelry manufacturing establishments in the major production centers offer the best opportunities for a young person to acquire all-round skills, even though the number of trainees accepted is small. Repair shops also offer training opportunities, but their small-size—many are one- or two-man shops—limits the number of trainees.

Jewelry workers may advance in several ways. In manufacturing, they can advance from production jewelers to shop foremen. In retail stores, jewelers may become heads of sales departments or store managers. Those craftsmen employed in jewelry making and repair departments operated by large retail establishments may advance to department managers. Some jewelry workers establish their own retail stores or repair shops.

A high school education is desirable for young people entering the trade. Courses in chemistry, mechanical drawing, and art are particularly useful. Jewelers or repairmen must be willing to sit for long periods of time. The precise and delicate nature of jewelry work requires finger and hand dexterity, good eye-hand coordination, patience, and concentration. Jewelry designers should be creative. People working with precious stones and metals must be bonded and investigated for honesty, trustworthiness, and respect for the law.

A substantial financial investment is required to open a retail jewelry store and the field is highly competitive in most parts of the country. Jewelers interested in going into business for themselves will find it advantageous to work first in an established retail jewelry store, repair shop, or jewelry manufacturing plant. Persons planning to open their own jewelry stores should have experience in selling jewelry. Those craftsmen who can repair watches have an advantage over those who can repair jewelry only, since watch repair work is a substantial part of the business in many small jewelry stores. Talented and experienced jewelers of recognized integrity can establish their own repair shops or small manufacturing shops with a more moderate financial investment. The location of these shops is limited to areas that have a large volume of jewelry business. For manufacturing, this means the major production centers; repair shops have best chances for success in moderate or large cities where there are many retail jewelry stores.

Employment Outlook

Employment requirements for jewelers and jewelry repairmen are expected to show little or no change although the 1970's. However, several hundred openings will arise annually because of retirements and deaths among experienced workers. Most job openings are expected to be filled by people trained in only one or two specialties of the trade such as stone setting, engraving, modelmaking, casting, or polishing. Nevertheless, all-round jewelers will continue to be in demand, and have been in short supply in recent years.

Rising levels of personal incomes are expected to result in a substantial increase in the demand for precious and costume jewelry, and an expected increase in family formations will spur demand for engagement and wedding rings. However, the employment effect of an increased demand for jewelry will be offset by more efficient means of producing and repairing jewelry.

The demand for jewelry craftsmen during the 1970's is expected to differ by place of employment. In jewelry manufacturing, most job openings will be filled by specialized craftsmen as mass-production techniques are adopted increasingly. In repair shops, where a large volume of repair work permits job specialization, job openings also will be filled mainly by specialized craftsmen. In retail jewelry stores, however, there will be job opportunities for both all-round jewelers and specialized craftsmen.

Earnings and Working Conditions

National earnings data are not available for jewelers and jewelry repairmen. However, information obtained in several major metropolitan areas from retail jewelry stores and repair shops indicated that beginning pay for jewelers and jewelry repairmen ranged from $80 to $125 a week in 1970; experienced workers earned up to $240 weekly. Wages were highest for jewelry repairmen who worked in large metropolitan areas. Jewelers who own retail stores or repair shops earn considerably more than jewelers working as employees in these establishments.

One union-management agreement, covering about 2,700 jewelry workers employed in plants manufacturing precious jewelry in New York City, provides the minimum hourly rates shown in the accompanying tabulation for inexperienced workers (including apprentices) and for journeymen in selected crafts, in 1971. Average hourly earnings also are shown in the tabulation.

Under this agreement, all inexperienced workers, including apprentices, receive increases of 15 cents an hour after 30 days of employment and 15 cents an hour every 3 months until they reach the minimum journeyman rate for their particular job, which is considerably

Occupation	*Average hourly earnings* 1971	*Minimum hourly job rate* 1971
Starting rate—all inexperienced workers	...	$2.00
Journeyman's rate:		
Production jewelers	$4.55	3.55
Jewelers—handmade work	5.50	4.05
Modelmakers	6.50	4.10
Stone setting:		
Diamond	5.55	4.05
Colored stones	4.25	3.75
Handmade work	5.80	4.30
Chasers	4.55	3.55
Engravers	4.55	3.55
Polishers	4.55	3.55
Casters	4.85	3.35
Lappers	5.30	3.80
Toolmakers	6.10	4.10
Hub Cutters	6.55	4.55

lower than average hourly earnings in the trades.

Skilled workers in the precious jewelry manufacturing union shops in the New York City area have a 35-hour workweek and are paid time and one-half for all work done before or after the regular workday. Retail jewelers and jewelry repairmen work 40 to 48 hours a week.

Sources of Additional Information

Information on employment opportunities for jewelers and jewelry repairmen in retail jewelry stores may be obtained from:

Retail Jewelers of America, Inc., 1025 Vermont Ave. NW., Washington, D.C. 20005.

Information on employment opportunities in manufacturing establishments may be obtained from:

Manufacturing Jewelers and Silversmiths of America, Inc., Sheraton-Biltmore Hotel, Room S-75, Providence, R.I. 02902.

International Jewelry Workers' Union, Local No. 1, 133 West 44th St., New York, N.Y. 10036.

MEAT CUTTERS

(D.O.T. 316.781, 316.884)

Nature of the Work

Meat cutters prepare meat, fish, and poultry for sale in supermarkets or wholesale food outlets. Their primary duty is to divide animal carcasses into steaks, roasts, chops, and other serving sized portions. They also prepare meat products such as sausage, corned beef, and meat loaf. Meat cutters who work in retail food stores may set up counter displays and wait on customers.

In cutting a beef carcass, the meat cutter divides it into halves with a band saw, and then quarters it by cutting each half between the ribs with a knife and sawing through the backbone. He uses special meat cutting saws to divide the quarters into major (primal) cuts, such as rib or chuck, and then uses a butcher knife and a smaller boning knife to divide the primal cuts into retail cuts such as T-bone steak or rib roast.

The meat cutter may divide the retail cuts into individually sized portions. He uses a butcher knife or slicer to divide boneless cuts and a band saw or cleaver to divide cuts containing bones. He removes any bone chips that remain on the meat either by scraping it with his butcher knife or placing the meat on a machine that has a small revolving brush. Finally, the meat cutter grinds trimmings and less expensive cuts into hamburger.

In addition to cutting meat, the meat cutter may pickle or "corn" meat by pumping a brine solution into the arteries. He may place some of the cuts on a tenderizer machine which increases tenderness by injecting an enzyme into the meat.

Places of Employment

The estimated 190,000 meat cutters employed in 1970 were located in almost every city and town in the Nation. Only a small proportion were women. Most meat cutters worked in retail food stores. A large number also worked in wholesale food outlets; a few worked in restaurants, hotels, hospitals, and other institutions.

Training, Other Qualifications, and Advancement

Meat cutters acquire their skills either through apprenticeship programs or on-the-job. Under the guidance of skilled journeymen meat cutters, trainees learn the identity of various cuts and grades of fresh meats and cold cuts and the proper use of tools and equipment. They learn to use scales, make counter displays, slice luncheon meats and cheese, wrap meat, and wait on customers.

Carcass breaking, boning, and portion cutting are a major part of the meat cutter's training. To perform carcass breaking—the successive division of the carcass into halves, quarters, and primal cuts—trainees learn to use the band saw, rotary saw, and butcher knife. During the boning operation, in which the excess skin, bones, and fat are removed and the primal cuts are divided into retail cuts, they learn to use the boning knife and to increase their skill with the butcher knife. Generally, the last cutting function trainees learn is portion cutting. During this phase, they learn to operate the slicer, grinder, and small band saw, and to use the revolving brush that removes bone chips.

In addition to cutting operations, beginning meat cutters learn to dress fish and poultry, roll and tie roasts, grind hamburger, prepare sausage, cure and corn meat, and may learn to use the vacuum and tenderizer machines. During the latter stages of training, they may learn marketing operations such as inventory control, meat buying and grading, and recordkeeping.

Meat cutters who learn the trade through apprenticeship generally complete 2 to 3 years of supervised on-the-job training which may be supplemented by some classroom work. At the end of the training period the apprentice is given a meat cutting test which is observed by his employer. A union member is also present in union shops. If the apprentice passes the test, he becomes a fully qualified journeyman meat cutter. In many areas of the country, the apprentice may become a journeyman in less than the usual training time if he is able to pass his meat cutting test at an earlier date.

The most common method of entering this occupation is to be hired and trained by an individual retail or wholesale outlet. A few meat cutters have gained entry by attending vocational schools that offer courses in meat cutting. Unemployed and underemployed workers seeking entry jobs as meat cutters are trained in many cities under the Manpower Development and Training Act.

Employers prefer entrants who have a high school diploma and also have the potential to develop into meat department or retail store managers. High school or vocational school courses in business arithmetic are helpful to young people interested in becoming meat cutters, since they may be called on to weigh and price meats and to make change. A pleasing personality, a neat appearance, and the ability to communicate clearly also are important qualifications because meat cutters may wait on and advise customers.

Manual dexterity, good form and depth perception, color discrimination, and good eye-hand coordination are important in cutting meat. Better than average strength is necessary since meat cutters often must lift heavy loads and stand on their feet much of the day. In some communities, a health certificate may be required for employment.

Meat cutters may progress from journeyman to first cutter and then to meat department manager of a retail food store. Some become meat buyers, and those who learn the operation of the grocery section of a retail outlet can become retail store managers. In a few instances, experienced meat cutters have opened their own meat markets or retail food stores.

Employment Outlook

Meat consumption is expected to increase substantially in the future due to population growth and increased personal income. However, little or no increase in the total number of meat cutters is anticipated through the 1970's, since rising worker productivity is expected to offset growth in meat consumption. Nevertheless, thousands of entry jobs for meat cutters will be available during the next decade to replace experienced workers who retire, die, or transfer to other occupations.

A number of technological advances are expected to limit employment growth of meat cutters. Such innovations include power tools, such as electric saws; electronic scales; wrapping machines that can weigh, package, and stamp prices automatically; and machines that tie strings on roasts or other boneless cuts. In the future, power assisted knives may be used for boning and portion cutting. A process is being tested that separates meat from bones by centrifugal force.

Central cutting, the establishment of one point from which meat for a given area is cut and wrapped, is expected to limit employment growth because fewer cutters will be needed in individual retail stores to cut or package meat. Central cutting also permits meat cutters to specialized in both the type of meat cut and the type of cut performed. This specialization reduces the amount of training necessary to become a skilled cutter.

In many wholesale outlets, a degree of specialization similar to that of central cutting is already in effect. Many wholesale outlets perform "portion cutting" for restaurants, hotels, and other institutions. Rather than keeping a meat cutter on the premises, the hotel or restaurant orders a desired number of serving-size portions from the wholesaler. The effect has been to displace some meat cutters formerly employed by hotels, restaurants, and other institutions.

Earnings and Working Conditions

According to union-management contracts in eight large cities in 1970, hourly earnings of most journeymen meat cutters ranged from $3.45 to $4.56 for a standard 40-hour work week. Some highly skilled meat cutters earned as much as $5.47 an hour.

Beginning apprentices usually receive between 60 and 70 percent of journeymen wages and generally receive increases every 6 to 8 months until they achieve the journeyman level. Most meat cutters are members of the Amalgamated Meat Cutters and Butcher Workmen of North America.

Meat cutters generally work in a well-lighted and well-ventilated environment. They must exercise care since sharp instruments, such as knives, grinders, saws, cleavers, scrapers, and shears, are used. To prevent accidents, most machinery is equipped with protective devices and safety gloves often are worn. Meat cutters are exposed to sudden temperature changes when entering and leaving refrigerated areas and may be exposed to unpleasant odors.

Sources of Additional Information

Information on training and other aspects of the trade may be obtained from:

American Meat Institute, 59 East Van Buren Street, Chicago, Ill. 60605.

Amalgamated Meat Cutters and Butcher Workmen of North America, 2800 North Sheridan Road, Chicago, Ill. 60657.

Further information about local work opportunities can be obtained from local employers or local offices of the State employment service. The State employment service also may furnish information about training opportunities under the Manpower Development and Training Act, apprenticeship, and other training programs.

MOTION PICTURE PROJECTIONISTS

(D.O.T. 960.382)

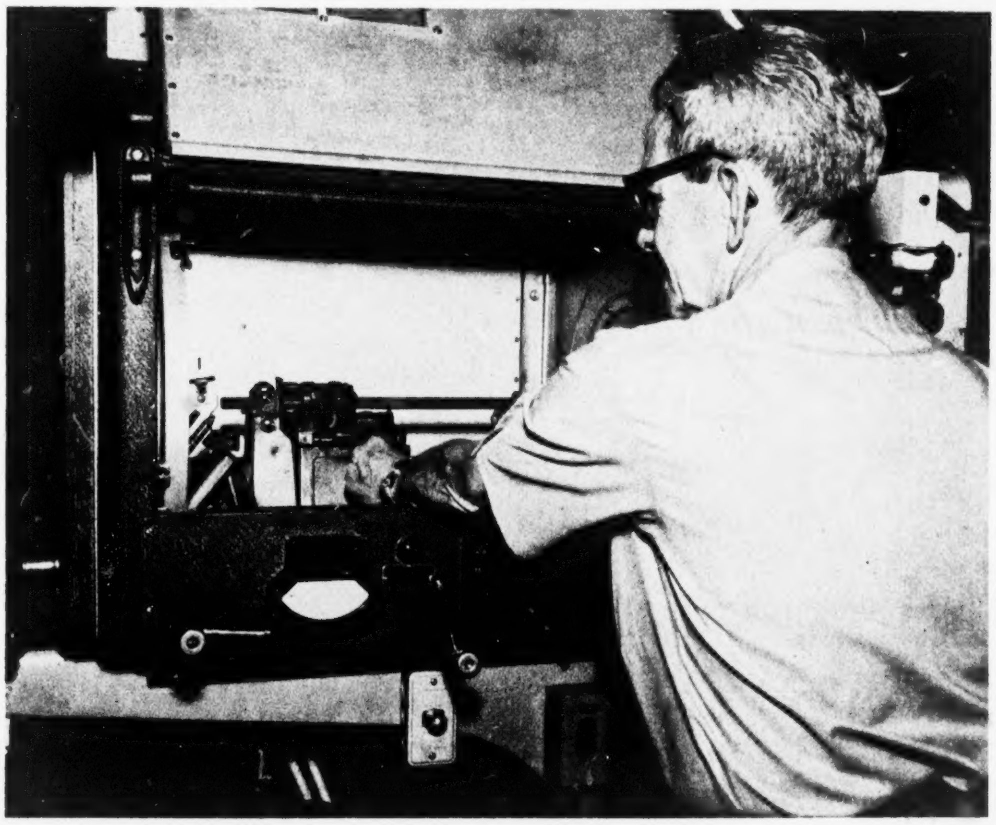
Nature of the Work

The projectionist is an important man behind the scenes in the motion picture theater. From an elevated room at the back of the theater, he operates the projection machines and audio equipment, assuring high quality screen and sound presentation for the audience.

In showing a feature length movie, the projectionist uses two projectors, audio equipment, a film rewinding machine, and seven reels or more of film. Before the first feature is scheduled to begin, he checks the equipment to see that it operates properly and loads the two projectors with the first and second reels to be shown. To load a projector he threads the film through a series of sprockets and guide rollers, and attaches it to a take-up reel. Most projectors burn a carbon rod to provide light for the screen. After igniting and adjusting the carbon rod, the projectionist starts the projector containing the first reel. When the reel has reached proper running speed, he opens a shutter and the picture appears on the screen. If the picture is out of focus or unsteady, he makes the necessary adjustments on the projector.

A film reel lasts approximately 20 minutes. When the first reel is near completion, the projectionist watches for cue marks (small circles in the upper right hand corner of the screen) which indicate that it is time to start the second projector. When a second series of cue marks appears, he simultaneously closes the shutter on the first projector and opens the shutter on the second projector. This changeover happens so quickly that the viewer in the audience does not notice an interruption on the screen. Next, the projectionist removes the used reel, and rewinds it on the rewinding machine. The projectionist repeats the process described above until all the reels have been used. If the film breaks the projectionist must work rapidly to rethread it so that the show may continue.

In addition to operating the equipment, the projectionist cleans and lubricates it, checks for defective parts and damaged film, and makes minor repairs and adjustments. By keeping his equipment in good operating condition, the projectionist reduces the possibility of malfunctions and breakdowns. For example, he may replace a badly worn projector sprocket which could eventually cause film damage or an unsteady picture. Major repairs are made by servicemen who specialize in projection and audio equipment.



Projectionist adjusts carbon arc lamp in projector.

Places of Employment

An estimated 15,000 full-time motion picture projectionists—nearly all of them males—were employed in 1970. More than three-fourths of them were employed in indoor theaters; most of the remainder were employed in drive-in theaters. Other employers of projectionists included large manufacturers, television studios, and Federal, State, and local governments. Most theaters employ one projectionist per shift; few employ more than two.

Projectionists work in cities and towns of all sizes throughout the country. In a theater located in a small town, the theater owner or a member of his family may perform the duties of the projectionist.

Training, Other Qualifications, and Advancement

Most motion picture theaters in urban areas are unionized, and young people who aspire to work as motion picture projectionists in these theaters must complete a period of apprenticeship. Apprenticeship applicants must be at least 18 years of age, and high school graduates usually are preferred.

The length of time a person must serve as an apprentice before taking an examination for union membership may vary from 1 to 2 years, depending on the policies of union locals. However, if he is capable of performing the work, an apprentice may be assigned to a full- or part-time job at journeyman's pay before becoming a member. In a few cities and States, projectionists must be licensed.

An apprentice learns the trade by working full or part time with experienced projectionists. He first learns simple tasks, such as threading and rewinding film. As he gains experience, he progresses to more difficult assignments such as adjusting and repairing equipment. He may work in several theaters to become familiar with different types of equipment. Some apprentices receive no pay while being trained. In a nonunion theater, a young man may start as an usher or helper and learn the trade by working with an experienced projectionist.

Young men interested in becoming projectionists should have good eyesight, including normal color perception and good hearing. They should be temperamentally suited to working alone in close quarters. Manual dexterity and mechanical aptitude are also important personal qualifications. Practical experience gained from operating small movie projectors at home, at school, or in the Armed Forces also is helpful.

Employment Outlook

Employment of motion picture projectionists is expected to increase slowly through the 1970's. Most job opportunities will arise as experienced workers retire, die, or transfer to other fields of work. Retirements and deaths alone may result in several hundred job openings annually, but competition for the available openings is likely to continue to be keen. Some of these openings will be filled by experienced projectionists who are unemployed or underemployed.

Employment of projectionists is closely related to the number of motion picture theaters. Following a rapid decline in the 1950's and early 1960's, the number of theaters has leveled off in recent years but is expected to increase slightly during the 1970's. Among the factors which may contribute to this increase are growing population, rising personal incomes, increased leisure time, and the continued movement of people to suburban areas.

Earnings and Working Conditions

Earnings data for motion picture projectionists are not available on a national basis. However, average straight-time hourly earnings for many projectionists in large metropolitan areas ranged from $2.95 to $8.75 in 1970 according to information from several union-management contracts. Generally, downtown theaters pay higher hourly rates than suburban or drive-in theaters.

Most projectionists work evenings. Generally, those employed on a full-time basis work 4 to 6 hours, 6 evenings a week. They may work more than 6 hours on Saturday in a theater which features Saturday matinees. Some projectionists work at several theaters. For example, a projectionist's weekly schedule may call for 2 evenings in each of three theaters. Projectionists employed in drive-in theaters, particularly those in Northern States, may be laid off for several months during the winter.

Many projectionists receive 2 or 3 weeks of paid vacation and premium pay for weekend or holiday work. Some projectionists are covered by hospitalization and pension plans.

The motion picture projectionist works in a room called a projection booth. In most theaters, these booths have adequate lighting, ventilation, and work space. Many booths are air-conditioned. The work is relatively free of hazards, but there is danger of electrical shocks and burns if proper safety precautions are not taken. The motion picture projectionist's work is not physically strenuous. He frequently lifts and handles film reels, but most of these weigh no more than 35 pounds. Although he must be on his feet much of the time, he can sit for short periods while the equipment is in operation. Most projectionists work without direct supervision and have infrequent contact with other theater employees.

Sources of Additional Information

Further information about apprenticeship programs and employment opportunities may be obtained from any local union of the International Alliance of Theatrical Stage Employees and Moving Picture Machine Operators of the United States and Canada.

PARKING ATTENDANTS

(D.O.T. 915.878)

Nature of the Work

Parking attendants are stationed near entrances of commercial and private parking facilities to move cars in and out of parking spaces. At commercial lots, the attendant meets incoming cars, records the time of arrival on a numbered claim ticket, gives the driver part of the ticket, and puts the other part in some clearly visible place on the car. Some establishments use a three-part claim ticket. In such cases, the attendant notes the car's parking space on the third part which is filed in the office. This procedure eliminates the attendant's looking for the car when the customer returns. Still other facilities use a "time plan" for handling cars. Under this system, customers

are asked the time they expect to return, and parking spaces are allocated to reduce the number of cars that must be moved when the customer returns. Next, in both commercial and private lots, the attendant drives the car to a vacant space or instructs the driver where to park. At multilevel parking garages, some attendants may drive cars up and down the ramps, while others park and retrieve cars on a particular floor. In a single level parking lot or garage, the attendant walks back to the entrance after he has parked the car. However, in many multilevel garages a moving manlift belt transports him to and from any floor.

In some commercial lots and garages, the attendant meets returning customers, tallies the parking charge, collects the fee, and retrieves the car. In large establishments, however, customers usually pay a cashier. The cashier gives the claim ticket to an attendant, who then retrieves the car.

Slack periods are common at most facilities. Some car parkers, therefore, may be expected to take on routine maintenance jobs around the lot or garage, or to wash and wax cars.

Places of Employment

In 1970, approximately 50,000 parking attendants worked full-time and thousands more were employed part-time. Many part-time attendants are young men working their way through school.

Parking attendants are employed at facilities that vary in size and type from small outdoor lots to vast multilevel parking garages. Although most parking establishments are commercial, some facilities are maintained privately by restaurants, hotels, airports, private clubs, or stores for the use of their patrons, members, or employees.

Training, Other Qualifications, and Advancement

Although no specific educational requirements exist for parking attendants, employers prefer high school graduates. Parking attendants must have a valid driver's license and be skillful in handling all types of cars. Clerical and arithmetic skills are helpful for attendants who keep records of claim tickets, compute parking charges, and make change.

Attendants also should be in good physical condition because the work involves long periods of standing and can be strenous during busy times. Since parking attendants deal with the public, they should be neat, tactful, and courteous.

Most organizations have on-the-job-training programs which improve the attendant's car handling ability and familiarize him with good customer relations, company policy, and record keeping procedures.

Car parkers have limited opportunities for advancement, although they may become managers or supervisors of a parking facility. Frequently, attendants use their driving skill to switch to related jobs such as truck driver, chauffeur, or routeman.

Employment Outlook

Employment of parking attendants is expected to grow slowly through the 1970's. Most new facilities are expected to be self-parking systems. Commercial parking owners favor the less costly self-park concept which eliminates many labor and customer relations problems. Customers generally prefer to park rather than entrust their cars to an attendant. In addition, traffic flow is smoother and faster in a self-park facility since attendants do not have to handle incoming and outgoing cars. Also, new construction techniques allow garages to be built with fewer supporting pillars for easier parking.

Despite the expected slow growth in the occupation, many openings are expected annually for parking attendants through the 1970's, primarily to replace attendants who die or retire, but especially to replace those who transfer to other occupations. Most job opportunities will be in large commercial parking facilities in the downtown areas of large cities.

Earnings and Working Conditions

Although parking attendants usually are not covered by minimum wage provisions, beginning salaries for parking attendants in 1970 were usually at or near the minimum of $1.60 an hour required by State and Federal laws. Some parking attendants, depending on the location and type of lot or garage, earn up to $2.00 or $3.00 an hour. Tips, which are common in this occupation, can boost regular earnings substantially.

Many car parkers receive fringe benefits such as life, health, and disability insurance; paid vacations; a Christmas bonus; and profit sharing. Some companies furnish uniforms. On the other hand, many attendants work long hours—a 10-hour day, night, weekend, and holiday work is not unusual. In addition, many car parkers spend much time outdoors in all kinds of weather and constantly breathe automobile exhaust fumes. In some places, attendants are responsible for any damage they do to customers' cars.

Sources of Additional Information

National Parking Association, 1101
17th St., NW., Washington, D.C.
10036

PHOTOGRAPHIC LABORATORY OCCUPATIONS

(D.O.T. 970.281; and 976.381, .687, .782, .884, .855, .886, and .887)

Nature of the Work

Amateur snapshots, home movies, professional portraits, and photographs to illustrate publications, such as magazines and catalogues, require the skills of thousands of photographic laboratory employees. These workers develop film, make prints and slides, and perform related tasks such as enlarging and retouching photographs. (This chapter does not discuss employees of laboratories that specialize in processing professional motion picture film.)

All-round darkroom technicians (D.O.T. 976.381) perform all tasks necessary to develop and print film. The technician varies the developing process according to the type of film—black-and-white negative, color negative, or color positive. For example, a developing process for black-and-white negative film covers five steps: developer, stop bath, fixing bath, washing, and drying. The first three steps involve the use of chemical solutions and are performed in darkness. After unwinding a roll of film, the technician places it in the developer, a solution that brings out the image on exposed film. After the film has remained in the developer for a specified period, the technician transfers it to a stop bath to prevent over-development. Next, he places the film in a fixing bath that makes it insensitive to light, thus preventing further exposure. He then washes the film with water to remove the fixing solution and places it in a drying cabinet. In many photographic laboratories, technicians regulate machines that automatically perform the steps described above.

Developing processes for color films are more complex than those used for black-and-white films. Thus, some laboratories employ *color technicians* (D.O.T. 976.381)—highly skilled workers who specialize in processing color film.

The darkroom technician makes a photograph by transferring the image from a negative to photographic paper. Printing frequently is performed on a projection printer, which consists of a fixture for holding negatives and photographic paper, an electric lamp, and a magnifying lens. The technician places the negative between the lamp and lens, and the paper below the lens. When he turns on the lamp, light passes through the negative and lens and records a magnified image of the negative on the paper. During printing, the technicians may vary the contrast of the image or remove unwanted background by using his hand or paper patterns to shade part of the photographic paper from the lamp light. After removing the exposed photographic paper from the printer, he develops it in much the same way as the negative. If the customer desires, the technician mounts the finished print in a frame or on a paper or cardboard back, using cement or a hand-operated press.

In addition to working in the laboratory, darkroom technicians may set up lights and cameras or otherwise assist experienced photographers. Many technicians, particularly those in portrait studios, divide their time between taking and processing pictures. In some laboratories, helpers assist technicians. They also may be assisted by workers who specialize in a particular activity, such as *developers* (D.O.T. 976.381), *printers* (D.O.T. 976.381), and *photograph retouchers* (D.O.T. 970.281).

In large, mechanized photographic laboratories, darkroom technicians may supervise semiskilled workers who perform specialized assignments that require only a limited knowledge of developing and printing. Included are *film numberers* (D.O.T. 976.887), who sort film according to the type of processing needed and number each roll for identification purposes; *film*

strippers (D.O.T. 976.887), who unwind rolls of film and place them in developing machines; *printer operators* (D.O.T. 976.782), who operate machines that expose rolls of photographic paper to negatives; *print developers, machine* (D.O.T. 976.885), who operate machines that develop these rolls of exposed photographic paper; *chemical mixers* (D.O.T. 976.884), who measure and combine the various chemicals that make up developing solutions; *slide mounters* (D.O.T. 976.885), who operate machines that cut, insert, and seal film in cardboard mounts; and *photocheckers and assemblers* (D.O.T. 976.687), who inspect the finished slides and prints and package them for customers.

Places of Employment

In 1970, an estimated 37,000 workers were employed in photographic laboratory occupations. More than half of them were in semiskilled photofinishing occupations; the remainder were darkroom technicians. Although most darkroom technicians are men, women predominate in many of the semiskilled occupations. For example, most printer operators, slide mounters, photocheckers, and assemblers are women.

A large proportion of darkroom technicians are employed in photographic laboratories operated by portrait and commercial studios and by business and government organizations. The latter include manufacturers, newspaper and magazine publishers, advertising agencies, and Federal, State, and local governments. Darkroom technicians also are employed in small commercial laboratories that specialize in processing the work of free-lance photographers, advertising agencies, magazine publishers, and others. Most semiskilled workers are employed by large commercial photographic laboratories that specialize in processing film for amateur photographers.

Training, Other Qualifications, and Advancement

Most darkroom technicians learn their skills through informal on-the-job training. Beginners start as helpers and gradually learn to develop and print film by assisting experienced technicians. It generally takes 3 or 4 years to become a fully qualified darkroom technician. Some helpers become specialists in a particular activity such as printing or developing. Generally, the training time required to become a specialist is less than is needed to become an all-round darkroom technician.

Employers prefer to hire darkroom technicians' helpers who have a high school education. Courses in chemistry, physics, and mathematics are helpful to young people interested in this trade. Some high schools and trade schools offer courses in photography that include training in film processing. The Armed Forces also offer training for darkroom technicians. Experience gained through processing film as a hobby is helpful.

Two-year curriculums leading to an associate degree in photographic technology are offered by a few colleges. Completion of college level courses in this field is helpful to people who are interested in supervisory and managerial jobs in photographic laboratories.

Many darkroom technicians eventually become professional photographers. Others advance to supervisory positions in laboratories. Technicians who acquire their experience in small laboratories need additional training before they can qualify for supervisory positions in large laboratories where mechanized equipment is used.

Training requirements for workers in semiskilled photographic laboratory occupations range from a few weeks to several months of on-the-job training. For example, film numberers and slide mounters usually can learn their jobs in less than a month, but printer operators and chemical mixers need several months or longer. For many semiskilled jobs, manual dexterity, good vision including normal color perception, and good eye-hand coordination are important qualifications. However, some laboratories employ blind workers as film numberers and film strippers, since these jobs may be performed in the dark to prevent damage to exposed film. Completion of high school generally is not required for semiskilled jobs, but it frequently is needed for advancement to supervisory jobs.

Employment Outlook

Employment in photographic laboratory occupations is expected to increase rapidly through the 1970's. In addition, many job opportunities will result from the need to replace experienced workers who retire, die, or transfer to other fields of work. Retirements and deaths alone are expected to create about a thousand job openings annually.

The need for semiskilled workers is tied closely to the growth of amateur photography. Film purchases by amateur photographers are expected to increase very rapidly through the 1970's as a result of rising population and personal income, more leisure time, and increased travel. Improvements in still and movie cameras that make them easier to load, unload, and operate also should contribute to increases in the use of film. However, the more widespread use of mechanized film processing equipment and improvements in this type of equipment will tend to increase the efficiency of laboratory workers and keep employment from growing as fast as the volume of film processed.

The need for all-round darkroom technicians is expected to increase as a result of the growing demand for photography in business and government. A major factor contributing to this demand will be the increasing variety of printed matter, such as sales brochures, catalogs, and public relations literature that is illustrated with photographs. The growing use of photography in research and development activities also will contribute to the demand for darkroom technicians. However, the generally favorable employment effects of these factors will be partially offset by the greater use of mechanized film processing equipment in small laboratories.

Earnings and Working Conditions

Information obtained from several employers in 1970 indicates that earnings of workers in photographic laboratory occupations vary greatly and depend on factors such as skill level, experience, and geographic location. Beginning pay for inexperienced darkroom technician's helpers generally ranged from $2 to $3.10 an hour. Most of the experienced all-round darkroom technicians earned between $2.50 and $5.00 an hour. In addition to all-round darkroom technicians, color technicians and printers generally had the highest earnings.

Workers in semiskilled occupations earned from $1.70 to $3.50 an hour. Among these workers, printer operators and chemical mixers generally had the highest earnings.

In the Federal Government, photographic laboratory technicians earned between $5,853 and $10,528 annually.

Many photographic laboratories provide paid holidays, vacations, and other benefits such as medical-surgical insurance. Workers in photofinishing laboratories operated by business and government organizations receive the same fringe benefits as their fellow employees.

The majority of photographic laboratory employees have a standard workweek of 40 hours and receive premium pay for overtime. In laboratories that specialize in processing film for amateur photographers, employees may work a considerable amount of overtime during the summer and for several weeks after Christmas. Many laboratories employ additional workers temporarily during these seasonal peaks.

Most photographic laboratory jobs are not physically strenuous. In many semiskilled occupations, workers perform their jobs while sitting, but the work is repetitious and the pace is rapid. Some of these workers (for example, printer operators and photocheckers and assemblers) are subject to eye fatigue. Photofinishing laboratories are generally clean, well lighted, and air conditioned.

Sources of Additional Information

Additional information about employment opportunities in photographic laboratories and schools that offer degrees in photographic technology may be obtained from:

Master Photo Dealers' and Finishers' Association, 603 Lansing Ave., Jackson, Mich. 49202.

Professional Photographers of America, Inc., 1090 Executive Way, Des Plaines, Ill. 60018.

POWER TRUCK OPERATORS

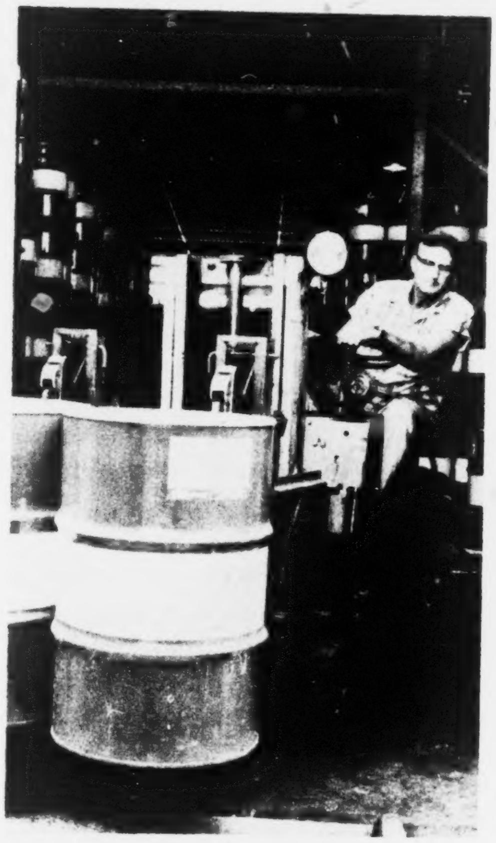
(D.O.T. 892.883; 921.782 and .883; and 922.782 and .883)

Nature of the Work

In the past, manual workers in factories usually did the hard physical labor of moving raw materials and products. Today, many heavy materials are moved by workers who operate various types of self-powered trucks. A typical truck operated by these workers has a hydraulic or electric lifting mechanism and special attachments for use on particular jobs. For example, the truck may have a fork lift to move piles of cartons, a scoop to lift coal, or a tow bar to pull small trailers.

The power truck operator uses pedals and levers to drive the truck and to control the lifting mechanism and attachments. The operator may be required to keep records of materials moved and do some manual loading and unloading of materials. He also may be responsible for keeping his truck in good working condition by cleaning, oiling, checking the water in batteries, and making simple adjustments.

The driver must use care and skill in driving his truck. For example, when loading or removing materials from stock, which may be stacked from floor to ceiling, he



must be able to judge distance so that no damage occurs. The operator also must know how much the truck can lift and carry and the kinds of jobs it can do.

Places of Employment

Approximately 200,000 power truck operators were employed in 1970. Power truck operators were employed in all types of manufacturing industries. Large numbers were employed in plants that manufactured automobiles and automobile parts, machinery, fabricated metal products, and iron and steel. Many power truck operators also were employed in warehouses, depots, dock terminals, mines, and other places where great quantities of materials must be moved.

Because power truck operators work in many different industries, they are employed in all parts of the country. Although some are employed in small towns, most work in heavily populated areas where large manufacturing plants are located.

Training, Other Qualifications, and Advancement

Most workers can learn to operate a power truck in a few days. It takes several weeks, however, to learn the physical layout and operation of a plant and the most efficient way of handling the materials to be moved.

Large companies generally require applicants to pass a physical examination. Many large companies also have formal training programs for new employees. In these training programs, the employee learns to operate the power truck, to do simple maintenance work, and to handle materials. He also learns plant layout and operation, and safe driving rules.

Young persons who are planning to become power truck operators should have manual dexterity, mechanical ability and above average eye-sight including good depth perception.

Some opportunities for advancement exist. A few operators may become materials-movement foremen or supervisors.

Employment Outlook

Employment of power truck operators is expected to increase slowly through the 1970's. Most job openings will result from the need to replace workers who retire, die, or transfer to other occupations.

The amount of goods manufactured is expected to increase as the Nation's population grows and its standard of living rises. More power truck operators will be needed to move these goods and the materials used to produce them. In addition, the growing use of containers for moving goods will increase the demand for operators. Employment growth will be limited, however, by the development of more efficient power trucks and other mechanized materials-handling equipment.

Earnings and Working Conditions

According to a survey covering 85 metropolitan areas in 1969–70, power truck operators had average straight time hourly earnings of $3.27 in manufacturing industries and $3.34 in nonmanufacturing industries. The following tabulation presents average hourly earnings by region for operators employed in manufacturing.

Average straight-time hourly earnings of power truck operators in manufacturing, 1969–70

Area	*Hourly rate*
United States	$3.27
Northeast	3.18
South	2.79
North Central	3.43
West	3.43

Power truck operators are subject to several hazards—such as falling objects and collisions between vehicles. Safety instruction is an important part of the job training in power truck work.

The driver may operate his truck inside buildings or outdoors where he is exposed to various weather conditions. Some operators may handle loose material that may be dirty or dusty.

Power truck operators have somewhat varied work in moving materials throughout a plant. Their work is likely to be less repetitive and routine than that of workers who do semiskilled machine operator work.

Many power truck operators are members of labor unions. Most labor-management contracts in manufacturing plants provide for fringe benefits such as paid holidays and vacations, health insurance, life insurance, and retirement pensions.

Sources of Additional Information

For further information on work opportunities for power truck operators, inquiries should be directed to the local office of the State employment service.

PRODUCTION PAINTERS

Nature of the Work

Almost every metal or wood product manufactured is given a coating of paint or other protective material. In mass-production industries, this painting is done by workers known as production painters. Most of them use spray guns to apply paint, lacquer, varnish, or other finishes. Some use brushes to apply paint and others operate semiautomatic paint spraying machines, dipping tanks, or tumbling barrels. The work of production painters in factories is different from that of skilled painters who are employed in construction and maintenance work. (See statements on Painters and Automobile Painters.)

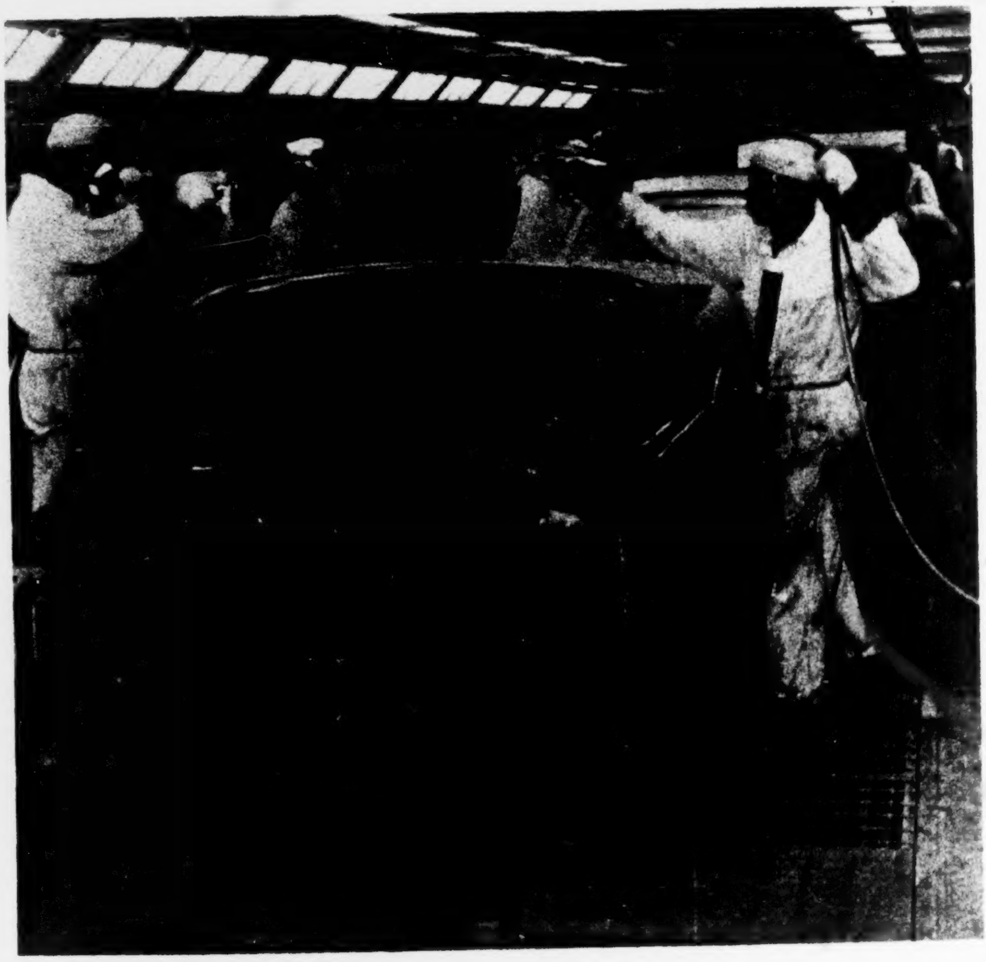
Production painters may have to clean items before painting them. When working on items requiring more than one color, they also apply masking tape to prevent overlapping of colors. Those who operate spray guns pour paints into a spraygun container that is attached to an air-compressor unit. They adjust the nozzle of the spray gun and the air-compressor so that the paint will be applied uniformly. Those who operate semiautomatic painting machines may load items into the machine or onto conveyors before applying paint.

Although the duties of most production painters are simple and repetitive, the jobs of some are varied. For example, they may have to make decisions involving the application of finishes, thinning of paint, and the adjustment of spray equipment. When required to mix paints and figure the size of the area to be painted, they use simple arthmetic involving decimals and fractions. Some production painters operate special spray guns such as those used to spray powdered plastics.

Production painters may replace nozzles and clean spray guns and other equipment when necessary. In addition to the painting equipment, they use tools, such as wrenches and mixing paddles, and gages that indicate the consistency of paint.

Places of Employment

About 115,000 production painters were employed in manufacturing in 1970, most of whom were men. More than four-fifths of the total worked in plants that manufactured furniture, automobiles, household appliances, industrial machinery, and other durable goods. Large numbers of production painters were employed in New York, Mich-



Production painters apply acrylic enamel to automobile body.

igan, Ohio, California, Illinois, Pennsylvania, Texas, North Carolina, and New Jersey.

Training, Other Qualifications, and Advancement

The new worker usually learns his job by observing and assisting experienced production painters. The length of training may vary from 2 weeks to several months.

A person going into this work needs good eyesight so that he can distinguish between colors and see whether the paint is applied evenly. He also should have a steady hand and be capable of standing for long periods. High school graduation is not generally required.

Opportunities for advancement are limited. A small number of production painters become inspectors and foremen.

Employment Outlook

Employment of production painters is expected to increase slowly through the 1970's. However, most openings will result as workers retire, die, or transfer to other occupations. Overall, several thousand job openings will arise each year during the decade.

Most manufacturing industries which employ production painters are expected to increase their output during the 1970's. Growth in population and personal income will increase the demand for consumer products such as automobiles and furniture. Business expansion will increase the demand for industrial machinery and equipment. Employment of painters, however, is not expected to keep pace with manufacturing output because automatic sprayers and other laborsaving innovations should raise output per worker.

Earnings and Working Conditions

National wage data on production painters are not available. However, information from a limited number of union-management contracts indicate that hourly rates ranged from about $2.05 to $4.10 in 1970.

Painters are exposed to fumes from paint and paint-mixing ingredients. Some wear protective goggles and masks which cover the nose and mouth. When working on large objects, they may work in awkward and cramped positions.

Many production painters are members of unions. Among the labor organizations to which they belong are the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the United Furniture Workers of America; and the United Steelworkers of America. Many union-management contracts provide for fringe benefits, such as holiday and vacation pay, health insurance, life insurance, and retirement pensions.

Sources of Additional Information

Additional information about employment opportunities in this field may be available from local offices of the State employment service.

SHOE REPAIRMEN

(D.O.T. 365.381)

Nature of the Work

Shoe repairmen replace worn heels, soles, and broken straps, and repair torn seams of all types of shoes. Highly skilled shoe repairmen may design, make, or repair orthopedic shoes in accordance with the prescription of orthopedists and podiatrists. They also may mend handbags, luggage, tents, boat covers, and other items made of leather, rubber, or canvas.

The most frequent tasks performed by shoe repairmen are replacing worn heels and soles. To resole a shoe, the repairman prepares the shoe by removing the worn sole and old stitching, and roughing the bottom of the shoe on a sanding wheel. Next, he selects a new sole or cuts one from a piece of leather and cements, nails, or sews it to the shoe. Finally, he trims the sole. To reheel a shoe, the repairman first pries off the old heel. He then selects a replacement heel or cuts one to the required shape, and cements and nails the new heel in place. The heel is then trimmed. After the heels and soles have been replaced, the shoe repairman stains and buffs them so that they match the color of the shoes. Sometimes he cements leather tips or nails metal heels and toe plates to the new heels and soles to increase their durability. Before completing the job, the repairman may replace the insoles, restitch any loose seams, and polish the shoes.

In large shops, shoe repair work often is divided into a number of specialized tasks. For example, some shoe repairmen may remove and replace heels and soles only; others only restitch torn seams.

Shoe repairmen use handtools and power and manually operated machines in their work. For example, they may use power operated sole stitchers and heel nailing machines, and manually operated sewing machines, cement presses, and shoe stretchers. Among the handtools they use are hammers, awls, and nippers.

Self-employed shoe repairmen have managerial, sales, and other responsibilities in addition to their regular duties. They make estimates of repair costs, prepare sales slips, keep records, and receive payments for work performed. They also may supervise the work of other repairmen.

Places of Employment

Nearly 60 percent of the estimated 25,000 shoe repairmen employed in 1970 were proprietors of small, one-man shoe repair shops. Most of the remaining craftsmen were employed in large shoe repair shops. Many of these large shops offered cleaning and laundering services in addition to shoe repairing. A few shoe repairmen worked in shoe repair departments of department stores, variety chain stores, shoe stores, and cleaning establishments.

The geographic distribution of shoe repairmen is similar to that of the Nation's population. For example, large numbers of shoe repairmen are employed in California, New York, Pennsylvania, Texas, and Illinois.

Training, Other Qualifications, and Advancement

Most shoe repairmen are hired as helpers and receive on-the-job training in large shoe repair shops. Helpers begin by assisting experienced repairmen with simple tasks, such as staining, brushing, and shining shoes, and progress to more difficult duties as they gain experience. Helpers having an aptitude for the work and initiative can become qualified shoe repairmen after 2 years of on-the-job training.

Some repairmen learn how to repair shoes in vocational schools that offer such training. Others receive their training under the provisions of the Manpower Development and Training Act; still others enter the occupation through apprenticeship training programs.

Skilled shoe repairmen who work in large shops can become foremen or managers. Those who have the necessary funds can open their own shops.

Employment Outlook

Employment of shoe repairmen is expected to show little or no change through the 1970's. Nevertheless, hundreds of openings will arise each year because of the need to replace experienced workers who retire, die, or transfer to other fields of work. Opportunities will be particularly favorable for the highly skilled because the number being trained is insufficient to meet current needs.

Although the sale of shoes will increase as the population grows, several factors are expected to limit the demand for repairmen. In recent years, the popularity of canvas footwear, loafers, sandals, and cushion-soled shoes, has increased. Because of their construction these types of shoes often cannot be repaired. In addition, many shoes are being made more durable, and need repair less frequently. Also, as personal income rises, many people buy new shoes rather than repair old ones.

Earnings and Working Conditions

National earnings data are not available for shoe repairmen. However, information obtained from a limited number of employers and union-management contracts in early 1970 indicated that many workers earned between $100 and $115 for a 40-hour week. Some highly skilled shoe repairmen, including managers of shoe repair shops, earned more than $150 a week. Inexperienced trainees generally earned between $65 and $75 a week.

Shoe repairmen generally work 8 hours a day, 5 or 6 days a week. The workweek for the self-employed, however, is often longer, sometimes 10 hours a day, 6 days a week. Although shoe repair establishments are busiest during the spring and fall, work is steady with no seasonal layoffs. Employees in large shops receive from 1 to 4 weeks' paid vacation, depending on the length of time employed. Usually, at least 6 paid holidays a year are provided.

Working conditions generally are good in large repair shops, shoe repair departments of shoe stores and department stores, and in the more modern shoe service stores. However, some repair shops may be crowded and noisy and have poor light or ventilation. Strong odors from leather goods, dyes, and stains may be present.

Shoe repair work is not strenuous, but does require physical stamina, since shoe repairmen must stand a good deal of the time.

Sources of Additional Information

Information about local work opportunities can be obtained from the local office of the State employment service, as well as shoe repair shops in the community. The State employment service also may be a source of information about training opportunities available under the Manpower Development and Training Act, apprenticeship, and other training programs.

STATIONARY ENGINEERS

(D.O.T. 950.782)

Nature of the Work

Stationary engineers operate and maintain boilers, diesel engines, turbines, generators, pumps, and compressors. This equipment is used to generate power and to control the temperature and humidity in factories and other buildings. Stationary engineers must operate and maintain the equipment according to State and local laws, since the safety of many people depends upon its proper functioning.

Stationary engineers must detect and identify any trouble that develops by watching and listening to machinery and by analyzing their readings of meters, gauges, and other monitoring instruments. They operate levers, throttles, switches, valves, and other devices to regulate the machinery so that it works efficiently. They also record such information as the amount of fuel used and the temperature and pressure of boilers.

Stationary engineers repair equipment, using handtools of all kinds, including precision tools. Common repairs involve reseating valves; replacing gaskets, pumps, packings, bearings, and belting; and adjusting piston clearance.

The duties of stationary engineers depend on the size of the establishment in which they work and the type and capacity of the machinery. However, their primary responsibilities are very much the same for all kinds of plants—safe and efficient operation of their equipment. In a large plant, the stationary engineer may have charge of the boiler room, and direct the work of assistant stationary engineers, turbine operators, boiler operators, and air-conditioning and refrigeration mechanics. In a small plant, the stationary engineer may operate and maintain equipment by himself.

Stationary engineer checks heat controls.

Places of Employment

In 1970, about 200,000 stationary engineers were employed in a wide variety of establishments, including power stations, factories, breweries, food-processing plants, steel mills, sewage and water-treatment plants, office and apartment buildings, hotels and hospitals. Federal, State, and local governments also employed large numbers of these workers. The size of establishments in which the engineers worked ranged from giant hydroelectric plants and large public buildings to small industrial plants. Most plants which operate on three shifts employ from 4 to 8 stationary engineers, but some have as many as 60. In many establishments, only one engineer works on each shift.

Because stationary engineers work in so many different kinds of industries, they are employed in all parts of the country. Although some are employed in small towns and in rural areas, most work in the more heavily populated areas where large industrial and commercial establishments are located.

Training, Other Qualifications, and Advancement

Many stationary engineers start as helpers or craftsmen in other trades and acquire their skills largely through informal on-the-job experience. However, most training authorities recommend formal apprenticeship as the best way to learn this trade because of the increasing complexity of the machines and systems.

In selecting apprentices, most joint labor-management apprenticeship committees prefer high school or trade school graduates between 18 and 25 who have received instruction in mathematics, mechanical drawing, machine-shop practice, physics, and chemistry. Mechanical aptitude, manual dexterity, and good physical condition also are important qualifications.

A stationary engineer apprenticeship customarily lasts 3 to 4 years. Through on-the-job training, the apprentice learns to operate, maintain, and repair boilers, pumps, air-conditioning and refrigeration machinery, and other equipment. He is taught to use electric grinders, lathes, and drill presses; precision-measuring instruments, such as calipers and micrometers; and equipment used to move machines, such as chains and hoists. On-the-job training is supplemented by classroom instruction and home study in practical chemistry, elementary physics, blueprint reading, applied electricity, and other technical subjects.

Persons who become stationary engineers without going through a formal apprenticeship program usually do so only after many years of experience as assistants to licensed stationary engineers. This practical experience usually is supplemented by technical or other school training or home study.

Eight States, the District of Columbia, and more than 50 large and medium-size cities have licensing requirements for stationary engineers. Although requirements for obtaining a license differ from place to place, the following are typical: (1) The applicant must be over 21 years of age; (2) he must have resided in the State or locality in which the examination is given for a specified period of time; and (3) he must demonstrate that he meets the experience requirements for the class of license requested. A license is issued to applicants who meet these requirements and pass an examination which may be written, oral, or a combination of both types.

Generally, there are several classes of stationary engineer licenses, which specify the steam pressure of horsepower of the equipment the engineer may operate. The first-class license permits the stationary engineer to operate equipment of all types and capacities. The lower class licenses limit the capacity of the equipment the engineer may operate without the supervision of a higher rated engineer.

Stationary engineers advance to more responsible jobs by being placed in charge of larger, more powerful, or more varied equipment. Generally, the engineer advances to these jobs as he obtains higher grade licenses. Advancement, however, is not automatic. For example, an engineer having a first-class license may work for some time as an assistant to another first-class engineer before a vacancy requiring a first-class licensed engineer occurs. In general, the broader knowledge he has of the operation, maintenance, and repair of various types of equipment, the better are his chances for advancement. Stationary engineers also may advance to jobs as plant engineers and as building and plant superintendents.

Employment Outlook

Employment of stationary engineers is expected to show little or no change through the 1970's. Nevertheless, several thousand job openings will arise annually because of the need to replace experienced workers who retire, die, or transfer to other occupations.

Industrial growth will result in increased use of large boilers and auxiliary equipment in factories, powerplants, and other buildings. The need for additional stationary engineers, however, will be limited by the trend to more powerful and more centralized equipment with automatic controls. For example, larger boilers make it possible to increase capacity without corresponding increases in the number of stationary engineers. In a growing number of plants, centralized control panels and closed circuit television monitoring systems will reduce the need for on-site observation of equipment. Automatic control systems which regulate throttles, valves, and other devices previously regulated by hand, also will increase the efficiency of stationary engineers.

Earnings and Working Conditions

According to a survey covering 75 metropolitan areas in 1969–70, stationary engineers had average straight-time hourly earnings of $4.14. Averages in individual areas ranged from $2.84 in Oklahoma City, Okla., to $4.98 in Chicago, Ill.

Stationary engineers generally have steady year-round employment. They usually work a straight 8-hour day and 40 hours a week. In plants that operate around the clock, they may be assigned to any one of three shifts—often on a rotating basis—and to Sunday and holiday work.

Many stationary engineers are employed in plants which have union-management contracts. Most of these contracts provide fringe benefits, which may include hospitalization, medical and surgical insurance; life insurance; sickness and accident insurance; and retirement pensions. Similar benefits also may be provided in plants which do not have union-management contracts. Among the unions to which these workers belong are the International Union of Operating Engineers and the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America.

Most engine rooms, powerplants, or boiler rooms are clean and well-lighted. However, even under the most favorable conditions, some stationary engineers are exposed to high temperatures, dust, dirt, contact with oil and grease, and fumes from oil, gas, coal, or smoke. They may have to crawl inside a boiler and work in a crouching or kneeling position to clean or repair the interior.

Because stationary engineers often work around boilers and electrical and mechanical equipment, they must be alert to avoid burns, electric shock, and injury from moving machinery. If the equipment is defective or is not operated correctly, it may be hazardous to them and to other persons in the vicinity.

Sources of Additional Information

Information about training or work opportunities in this trade may be obtained from local offices of State employment services, locals of the International Union of Operating Engineers, and from State and local licensing agencies.

Information about the occupation also may be obtained from:

International Union of Operating Engineers, 1125 17th St., NW., Washington, D.C. 20036.

National Association of Power Engineers, Inc., 176 West Adam St., Chicago, Ill. 60603.

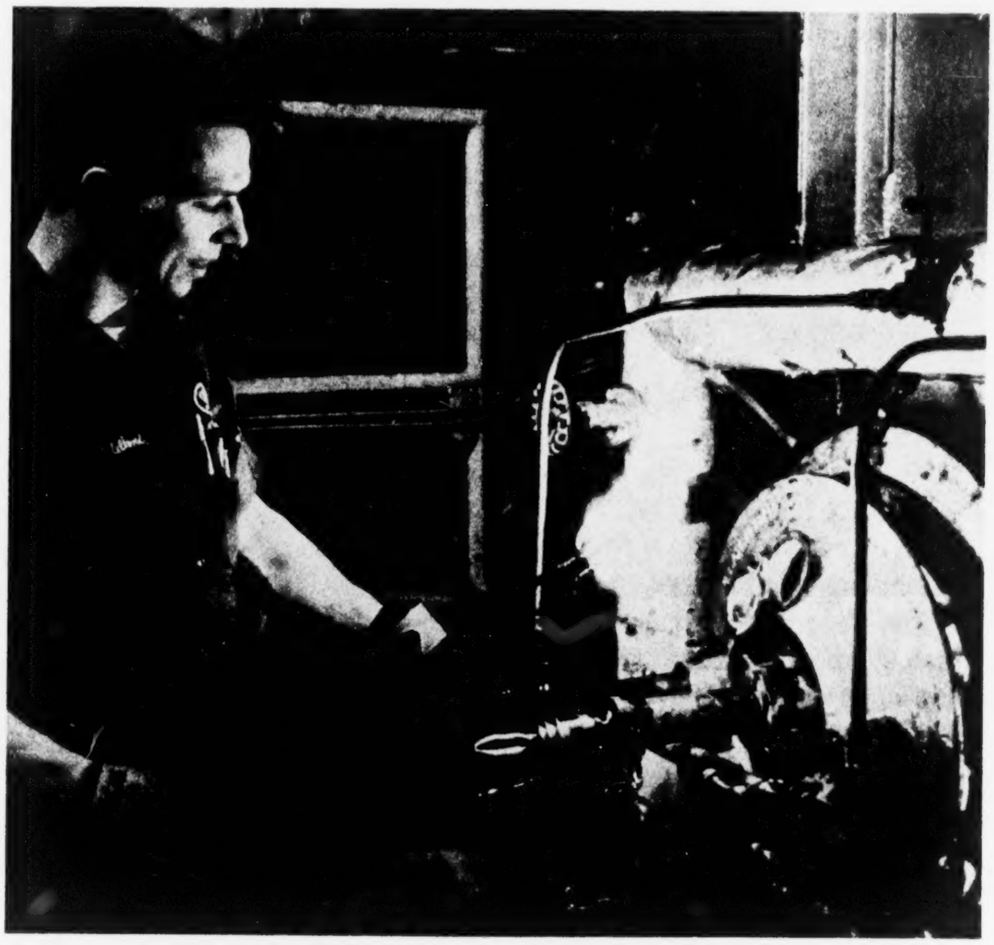
STATIONARY FIREMEN (BOILER)

(D.O.T. 951.885)

Nature of the Work

Stationary firemen are semi-skilled workers who operate and maintain the steam boilers which are used to power industrial machinery and to heat factories, offices, department stores, and other buildings. Highly experienced firemen may be responsible for inspecting boiler equipment, lighting boilers, and building up steam pressure. On the other hand, the responsibilities of some firemen are limited to keeping equipment in good working order by cleaning, oiling, and greasing parts.

In most plants, stationary firemen operate mechanical devices that control the flow of air, gas, oil, or powdered coal into fireboxes in order to keep proper steam pressure in boilers. Duties of these workers include reading meters and other instruments to be certain that the



Stationary fireman lights boiler.

boilers are operating efficiently and according to safety regulations. In some plants they make minor repairs.

Stationary firemen often are supervised by stationary engineers who are responsible for the operation and maintenance of a variety of equipment, including boilers, diesel and steam engines, and refrigeration and air-conditioning equipment. (Additional information on stationary engineers appears elsewhere in the *Handbook.*)

Places of Employment

About 70,000 stationary firemen were employed in 1970. Most of them worked in manufacturing industries. Plants that manufacture lumber, iron and steel, paper, chemicals, and transportation equipment are among the leading employers of stationary firemen. Public utilities also employ many of these workers.

Stationary firemen are employed in all parts of the country. Although some are employed in small towns and even rural areas, most work in the more heavily populated areas where large manufacturing plants are located.

Training, Other Qualifications, and Advancement

Some large cities and a few States require stationary firemen to be licensed. Applicants can obtain the knowledge and experience to pass the license examination by first working as a helper in a boiler room, or by working as a stationary fireman under a conditional license.

License requirements differ from city to city and from State to State. However, the applicant usually must prove that he meets the experience requirements for the license, and pass an examination which tests his knowledge of the job. For specific information on licensing requirements, consult your State or local licensing authorities.

There are two types of stationary firemen licenses—for low and high pressure boilers. Low pressure firemen operate boilers generally used for heating buildings. High pressure firemen operate the more powerful boilers and auxiliary boiler equipment used to power machinery and to heat large buildings. Both high and low pressure operators, however, may operate equipment of any pressure class if a stationary engineer is on duty.

Stationary firemen should understand the operation of machinery, and must have normal vision and good hearing. Because of the mechanization of equipment, physical strength is no longer a major requirement for this type of work.

Stationary firemen may advance to jobs as stationary engineers. To help them qualify for advancement, firemen sometimes supplement their on-the-job training by taking courses in practical chemistry; elementary physics; blueprint reading; applied electricity; and the principles of refrigeration, air conditioning, ventilation, and heating. Stationary firemen also may advance to jobs as maintenance mechanics.

Employment Outlook

Employment of stationary firemen is expected to decline through the 1970's. Hundreds of job openings, however, will result each year from the need to replace experienced firemen who transfer to other occupations, retire, or die.

Although an increase in the use of stationary boilers and auxiliary equipment is expected during the 1970's, the trend to automatic, more powerful, and more centralized equipment is expected to result in a decline in employment of stationary firemen. In large plants, however, where turbines and engines are housed under a separate roof and where there is a need for constant surveillance of boilers, firemen will continue to be needed.

Earnings and Working Conditions

According to a survey covering 60 metropolitan areas in 1969–70, stationary firemen had average straight-time hourly earnings of $3.47. Averages in individual areas ranged from $2.18 in Greenville, S.C. to $4.53 in Detroit, Mich.

Most stationary firemen, even under the most favorable conditions, are at times exposed to noise, heat, grease, and fumes from oil, gas, coal, or smoke. They may have to crawl inside a boiler and work in a crouching or kneeling position to do repair or maintenance work. Stationary firemen are subject to burns, falls, and injury from moving machinery. Boilers and auxiliary equipment that are not operated correctly, or are defective, may be dangerous to these workers and to other persons in the work vicinity. Modern equipment and safety procedures, however, have reduced accidents considerably in recent years.

Many stationary firemen are employed in plants that have labor-management contracts, most of which provide benefits that may include paid holidays and vacations, hospitalization, medical and surgical insurance, sickness and accident insurance, and retirement pensions. Among the unions to which these workers belong are the International Brotherhood of Firemen and

Oilers and the International Union of Operating Engineers.

Sources of Additional Information

Information about training or work opportunities in this trade may be obtained from local offices of State employment services, locals of the International Brotherhood of Firemen and Oilers, and from State and local licensing agencies.

Information about the occupation also may be obtained from:

International Brotherhood of Firemen and Oilers, 200 Maryland Ave. NE., Washington, D.C. 20002

WASTEWATER TREATMENT PLANT OPERATORS (SEWAGE-PLANT OPERATOR)

(D.O.T. 955.782)

Nature of the Work

Clean water is essential for the health and recreational enjoyment of the population and for the existence of fish and other wildlife. Wastewater treatment plant operators protect America's water resources by controlling water pollution through removal of domestic and industrial waste.

Domestic and industrial waste is carried by water through sewers and arrives at treatment plants in a diluted state. Frequently other materials such as sticks, boards, sand, rags, and grit also are present. Wastewater treatment plant operators control equipment and facilities to remove waste materials or render them harmless to human, animal, and fish life. By operating and maintaining pumps, piping, and valves that connect the collection system to the wastewater treatment facility, operators move the wastewater through the various treatment processes.

Operators perform routine tasks according to a regular schedule. These routine tasks include reading meters and gages and entering the information on log sheets. For example, an operator may monitor meters that record the volume of flow of wastewater (sewage) into a plant or he may read gages that measure the level of water in a well and provide information needed to ascertain normal pump action. Other tasks may include operating screening devices for removing larger objects; making minor repairs on valves, pumps, and other equipment; sampling wastewater at various stages of treatment for laboratory analysis and testing and correcting the level of chlorine in the water. Operators also lubricate equipment and hose down walls and tanks to break up scum and sludge. In the performance of their duties, operators may be required to use wrenches, pliers, hammers, and other handtools.

Occasionally operators must work under emergency conditions —for example, a pump may breakdown and incoming wastewater may flood the station. An operator may make emergency repairs or locate and report the malfunction to a foreman or supervisor.

Duties of an operator depend largely on the size of the treatment plant and complexity. In smaller plants, the operator may be responsible for the entire system, including repairs, filling out forms, handling complaints, as well as patrolling and housekeeping duties such as painting and cutting grass. In larger plants, the staff may include helpers, foremen, and chief operators. Their responsibilities range from those of helpers, who perform primarily housekeeping duties, to those of chief operators who supervise the entire operation.

Places of Employment

Of the approximately 30,000 wastewater treatment plant operators in 1970, about 4,000 worked in industrial wastewater treatment plants, 25,000 in municipal plants throughout the Nation, and another 1,000 in Federal installations.

The geographical distribution of treatment plants parallels the population pattern of the United States. About one-half of all wastewater treatment plant operators worked in the following eight States: California, Illinois, New York, Ohio, Texas, Pennsylvania, Florida and New Jersey.

Training, Other Qualifications, and Advancement

Entry jobs generally do not require specific training, and most operators learn their skills on-the-job. New workers usually start as helpers and are assigned to work under the direction of an operator. They learn by helping in routine tasks, such as recording meter readings; taking samples of wastewater and sludge; and doing simple maintenance and repair work on pumps, electric motors, valves, and pipes. They also are expected to perform housekeeping tasks such as cleaning and maintaining plant equipment and property.

Many wastewater treatment plant operators are trained in programs approved under the provisions of the Manpower Development and

Training Act. Young people who are interested in entry positions should have some mechanical aptitude and be able to perform simple calculations. Employers generally prefer applicants who have a high school diploma or its equivalent. Some treatment operators, particularly in larger municipalities, are covered by civil service regulations, and applicants may be required to pass written examinations covering elementary mathematics, mechanical aptitude, and general intelligence. Operators must be agile, since they have to be able to climb up and down ladders and move easily around heavy machinery. They must have the physical stamina to work outdoors in all kinds of weather.

Most State water pollution control agencies offer some short term course training to improve the skills of water treatment plant operators. These courses cover principles of sludge digestion, odors and their control, chlorination, sedimentation, biological oxidation, and flow measurements. In some cases, operators take advantage of correspondence courses on subjects related to wastewater treatment. Some large municipalities will pay part of the tuition for courses leading to a college degree in science or engineering.

Operators may be promoted to foremen and chief operators. Chief operators of large and complex plants are expected to have a bachelor's degree in science or engineering. A high school diploma or its equivalent, and successively responsible experience usually is sufficient to qualify as chief operator of a small or medium-sized plant. A limited number of operators may become technicians employed by local or State water pollution control agencies to collect and prepare water and biological samples for laboratory examinations. Some technical-vocational school or junior college training is generally preferred for technician jobs. Some operators become consulting engineers.

All but 3 of the 50 States have certification programs designed to improve treatment plant operations and raise employee stature. Twenty-seven States (California, Connecticut, Delaware, Georgia, Illinois, Indiana, Iowa, Kentucky, Maine, Maryland, Michigan, Montana, New Hampshire, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, South Dakota, Texas, Virginia, West Virginia, and Wisconsin) have adopted mandatory certification laws providing for the examination of operators and certification of their competence to supervise the operation of treatment plants. In addition to requiring the certification of supervisory operators, these States encourage other operators to become certified. Voluntary certification programs are in effect in 22 States, and municipalities in these States are urged to employ certified operators.

Under a typical licensing program, there are four classes of certification that relate as nearly as possible to corresponding classifications for wastewater treatment plants. For example, to be certified a Class I operator (corresponding to a Class I plant serving a population of less than 2,000), an applicant may be required to demonstrate general knowledge of treatment operations by passing a written examination, be a high school graduate, and have completed 1 year of acceptable employment at a treatment plant. Requirements for certification as a

Class IV operator (corresponding to a Class IV plant serving a population in excess of 40,000) may be a college degree or completion of 2 years of college in science or engineering; 5 years of treatment plant experience at a Class III plant or higher, 2 years of which were in a position of major responsibility; and specific knowledge of the entire field of wastewater treatment as demonstrated through a written examination.

Employment Outlook

Employment of operators is expected to rise rapidly through the 1970's, mainly as a result of the construction of new treatment plants to process the increasing amount of domestic and industry wastewater. Employment growth also should result from expansion of existing plants to include more advanced treatment to cope more effectively with water pollution. In addition to the new jobs that will result from growth, approximately 1,200 job openings are expected each year due to deaths and retirements.

Larger and more complex municipal and industrial treatment plants and the consolidation of smaller plants are expected to increase through the 1970's. In 1968, about 9 out of 10 communities having sewer systems had wastewater treatment plants. By 1980, almost all communities are expected to have such services.

Earnings and Working Conditions

Information from a survey covering a number of municipalities revealed earnings of operators ranged from approximately $5,000 to $11,000 a year in early 1971. Foremen earned up to $12,000 per year and chief operators as much as $22,000. Salaries for trainees were roughly 80 percent of the operators' salaries in most cities. These data reflect information collected from a number of municipalities in various parts of the United States.

Fringe benefits provided for plant operators usually are similar to those received by other municipal civil service employees. Many operators receive paid vacations and holidays, overtime, shift differential pay, sick leave, paid life insurance, paid hospitalization, and retirement benefits.

Because pollution control is continuous, operators work different shifts and in an emergency may have to work overtime. When working outdoors, operators are exposed to all kinds of weather. Operators also may be exposed to unpleasant odors and hazardous conditions, dust, and toxic fumes in the atmosphere, as well as noise from the operation of electrical motors, pumps, and gas engines. However, odor is kept to a minimum by the use of chlorine. Many plants are modern, have good lighting, clean wash-rooms equipped with showers, and a lunch room for the operator. The site is usually landscaped with well groomed lawns and shrubbery. For the most part the tanks are open but the pipes and sludge digestion tanks are beneath the ground or covered.

Young people interested in a career in wastewater treatment should contact their local or State water pollution control agencies. Additional information may be obtained from:

Water Pollution Control Federation, 3900 Wisconsin Ave., NW., Washington, D.C. 20016.

Division of Manpower and Training Federal Water Quality Administration U.S. Department of the Interior, Washington, D.C. 20242.

Consumer Protection and Environmental Health Services, Department of Health, Education, and Welfare, 200 C. St., SW., Washington, D.C. 20204.

WELDERS AND OXYGEN AND ARC CUTTERS

(D.O.T. 810. through 819.887)

Nature of the Work

Welding is one of the most common and dependable means of joining metal parts. Many of the parts in automobiles, missiles and spacecraft, airplanes, household appliances, and thousands of other products are joined by this process. Structural metal used in the construction of bridges, buildings, storage tanks, and other structures is often welded. Welding also is used widely to repair broken metal parts.

Welding is a method of joining pieces of metal by applying heat, pressure, or both, with or without filler metal, to produce a permanent bond. Although there are more than 40 different welding processes, most of the processes fall under three basic categories; arc, gas, and resistance welding. Arc and gas welding can be performed manually or by machine. Resistance welding is mainly a machine process.

Closely related to welding is oxygen and arc cutting (often referred to as flame cutting). Oxygen and arc cutters cut or trim metal objects to a desired size or shape. They also remove excess metal from castings and cut scrap metal into pieces of manageable size.

Most manual welding is done by

skilled or semiskilled arc and gas welders. The skilled welder plans and lays out work from drawings, blueprints, or other written specifications. He knows the welding properties of steel, stainless steel, cast iron, bronze, aluminum, nickel, and other metals and alloys. He also is able to determine the proper sequence of work operations for each job and to weld all types of joints in various positions (flat, vertical, horizontal, and overhead). The semiskilled manual welder usually does repetitive work which requires the welding of surfaces in only one position, and does not involve critical safety and strength requirements.

In one of the most common arc welding processes, the welder obtains a suitable electrode and adjusts the electric current. The welder first "strikes" an arc (creates an electric circuit) by touching the metal with the electrode. After the arc is made, the welder guides the electrode at a suitable distance from the edges to be welded. The intense heat caused by the arc melts the edges and the electrode tip. The molten metal from the electrode is deposited in the joint and, with the molten metal edges, solidifies to form a solid connection. Many welders specialize in arc-welding processes that use inert gas to shield the weld area. This type of welding is used mainly to join hard-to-weld metals such as aluminum and stainless steel.

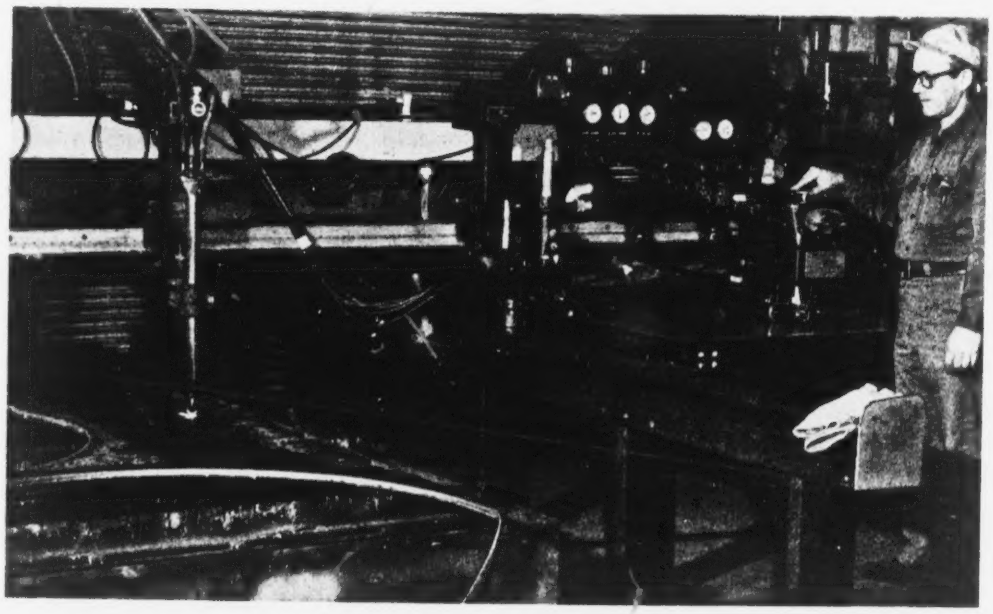
In gas welding, the welder uses a gas torch to apply an intensely hot flame (obtained from the combustion of a mixture of fuel gas—mostly commonly acetylene and oxygen) to the metal edges. After obtaining the proper welding rods and torch tips and adjusting the regulators on the oxygen and acetylene cylinders, the welder lights the torch. He then adjusts the oxygen and acetylene valves to obtain the proper size and quality of flame—depending on the type of metal and the joint to be made. The welder directs the flame against the metal until the heat begins to melt it. He then applies the welding rod to the molten metal to supply additional metal for the weld.

In production processes, especially where the work is repetitive and the items to be welded are relatively uniform, the welding may be done by semiskilled workers who operate welding machines. In resistance welding, the most common type of machine welding, *resistance welding operators* (D.O.T. 813.885) feed and aline the work and remove it after the welding operation is completed. Occasionally, they may adjust the controls of the machine for the desired electric current and pressure.

Workers other than welders frequently use welding. In construction for example, the structural steel worker, plumber and pipefitter, and sheet-metal worker may do manual arc and gas welding. Also, maintenance and repair work provide many welding opportunities for other metalworking and related occupations. (See Index for individual statements on these occupations.)

Semiskilled *oxygen cutters* (D.O.T. 816.782 and .884) and *arc cutters* (D.O.T. 816.884), sometimes called flame or thermal cutters, usually use hand-guided torches to cut or trim metals. The oxygen cutter directs a flame of fuel gas burning with oxygen on the area to be cut until the metal begins to melt. He then releases an additional stream of oxygen which cuts the metal. He guides the torch along previously marked lines or follows a pattern. He may mark guidelines on the metal by following blueprints or other instructions. Arc cutting differs from oxygen cutting because an electric arc is used as the source of heat. An arc with a hollow electrode through which oxygen passes is used in underwater cutting. Other special forms of the arc, such as the plasma arc, are used to cut ferrous and nonferrous metals.

Oxygen and arc cutters also may operate a torch or torches mounted on an electrically or mechanically



Flame cutters operate a travel graph and oxyacetylene cutting machine.

controlled machine which automatically follows a pattern.

Places of Employment

In 1970, an estimated 535,000 welders and oxygen and arc cutters were employed throughout the country. About 385,000 of these workers were employed in manufacturing industries, mostly in those making durable goods, such as transportation equipment and fabricated metal products. Of the approximately 150,000 welders and cutters in other industries, the greatest number were employed in construction firms and establishments performing miscellaneous repair services; the remainder were widely scattered among other nonmanufacturing industries.

The widespread use of the welding and cutting processes enables these workers to find jobs in every State. Most of the jobs, however, are found in the major metalworking areas. In 1970, about half of the welders and cutters were employed in seven States—Pennsylvania, California, Ohio, Michigan, Illinois, Texas, and New York.

Training, Other Qualifications, and Advancement

Generally, several years of on-the-job training are required to become a skilled manual arc or gas welder, and somewhat longer to become a combination welder (an individual skilled in both arc and gas welding). Some skilled jobs may require a knowledge of blueprint reading, welding symbols, metal properties, and electricity. Some of the less skilled jobs, however, can be learned after a few months on-the-job.

Training requirements for the resistance-welding machine operator's job depend upon the particular type of equipment used; most of these operators learn their work in a few weeks. Little skill is required for most oxygen and arc-cutting jobs; generally, they can be learned in a few weeks of on-the-job training. However, the cutting of some of the newer alloys requires a knowledge of the properties of metals as well as greater skill in cutting.

A young person planning a career as a welder or cutter needs manual dexterity, good eyesight, and good eye-hand coordination. He should be able to concentrate on detailed work for long periods. He must be free of any physical disabilities that would prevent him from bending, stooping, and working in awkward positions.

For entry in manual welding jobs, most employers prefer to hire young men who have high school or vocational school training in welding methods. Courses in mathematics, mechanical drawing, and blueprint reading also are valuable.

Beginners often start in simple manual welding production jobs where the type and thickness of metal, as well as the position of the welding operation, rarely change. Occasionally, they are first given jobs as oxygen or arc cutters; they later move into manual welding jobs. Some large companies employ general helpers in maintenance jobs who, if they show promise, may be given opportunities to become welders by serving as helpers to experienced welders and learning the skills of the trade on the job.

A formal apprenticeship generally is not required for manual welders. However, a few large companies (for example, automobile manufacturers) offer apprenticeship programs that run as long as 8,000 hours for the welding occupations. Also, the U.S. Department of the Navy, at several of its installations, conducts 4-year welding apprenticeship programs for its civilian employees.

Programs to train unemployed and underemployed workers for entry level welding jobs or to upgrade welding skills were operating in many cities in 1970 under the Manpower Development and Training Act. The training, which may be in the classroom or on-the-job and last from several weeks up to 1 year, stresses the fundamentals of welding. Additional work experience and further on-the-job training may qualify graduates as skilled welders in a relatively short time.

Before being assigned a job where strength of the weld is critical, welders may have to pass a qualification test given by an employer, municipal agency, naval facility, or private agency designated by local inspection authorities. In addition, some localities require welders to obtain a license for certain types of outside construction. Skill requirements are being increased in some industries, particularly in fields such as atomic energy or missile manufacture, which have high standards and require precise work.

After 2 years' training at a vocational school or technical institute, the skilled welder may qualify as a welding technician. Generally, workers in this small but growing occupation interpret engineers' plans and instructions. Occasionally, a welder may be promoted to inspector to check welds for general conformance with specifications and quality of workmanship. Welders also may become foremen. A small number of experienced welders establish their own welding and repair shops.

Employment Outlook

Employment of welders is expected to increase rapidly through the 1970's as a result of the generally favorable longrun outlook for metalworking industries and the wider use of the welding process. In addition to job openings created by employment growth, several thousand openings will arise annually because of the need to replace experienced workers who retire, die, or transfer to other occupations.

Many more manual welders will be needed for maintenance and repair work in the growing metalworking industries. The number of manual welders in production work is expected to increase in plants manufacturing sheet-metal products, boilers, storage tanks, ships, and other structural-metal products. The construction industry will need an increasing number of welders as the use of welded steel structure expands.

Employment prospects for resistance welders are expected to continue to be favorable because of the increased use of machine resistance-welding in the manufacture of motor vehicles, aircraft and missiles, railroad cars, and other products. The use of faster and more highly automatic welding machines, however, will slow down the growth in the number of these welders.

The number of jobs for oxygen and arc cutters is expected to rise somewhat during the years ahead as the result of the general expansion of metalworking activity. The increased use of oxygen- and arc-cutting machines, however, will tend to restrict the growth of this occupation.

Earnings and Working Conditions

A welder's earnings depend to a great extent on the skill requirements of his job and on the industry or activity in which he is employed. Earnings of highly skilled manual welders generally compare favorably with those of other skilled metalworking occupations. Machine welders, such as resistance welders, who require little training, usually earn less than manual welders.

Skilled manual welders in the fabricated structural steel industry averaged $3.29 an hour in late 1969, according to a survey conducted in 6 major cities. Averages for these workers in individual cities ranged from $2.81 in Houston to $3.74 in Los Angeles.

Many welders and cutters are union members. Among the unions organizing these workers are the International Association of Machinists and Aerospace Workers; the International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada; and the United Electrical, Radio and Machine Workers of America (Ind.). Only one labor organization —the International Union, United Weldors (Ind.), is known to be composed entirely of welders, employed largely in the aircraft industry on the west coast.

Labor-management contracts covering welders and cutters provide benefit programs which may include paid holidays and vacations, hospitalization, medical and surgical insurance, life insurance, sickness and accident insurance, and retirement pensions.

Safety precautions and protective devices are extremely important for welders and cutters because of the many hazards associated with the work. They use protective clothing, goggles, helmets with protective lenses, and other devices to prevent burns and eye injuries. Although lighting and ventilation are usually adequate, they occasionally work in the presence of toxic gases and fumes generated by the melting of some metals. They are often in contact with rust, grease, paint, and other elements found on the surface of the metal. Operators of resistance-welding machines are largely free from the hazards associated with hand welding. A clear eyeshield or clear goggles generally offer adequate protection to these operators.

Sources of Additional Information

For further information regarding work opportunities for welders and cutters, inquiries should be directed to local employers or the local office of the State employment service. The State employment service also may be a source of information about the Manpower Development and Training Act, apprenticeship, and other programs that provide training opportunities. General information about welders may be obtained from:

The American Welding Society, 345 East 47th St., New York, N.Y. 10017.

International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers, 8th at State Ave., Kansas City, Kans. 66101.

International Association of Machinists and Aerospace Workers, 1300 Connecticut Ave. NW., Washington, D.C. 20036.

International Union, United Automobile, Aerospace and Agricultural Implement Workers of America, 8000 East Jefferson Ave., Detroit, Mich. 48214.

United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada, 901 Massachusetts Ave. NW., Washington, D.C. 20001.

State Supervisor of Trade and Industrial Education or the local Director of Vocational Education in the State or city in which a person wishes to receive training.

SOME MAJOR INDUSTRIES AND THEIR OCCUPATIONS

AGRICULTURE

The United States is in the midst of an agricultural revolution that is having a tremendous impact on the employment outlook in agriculture.

In brief, fewer and fewer farmers are producing more and more of America's farm products. Employment on U.S. farms has declined from 9.9 million in 1950 to 4.5 million in 1970. Agricultural economists predict that by 1980 U.S. farms will employ only 3 million to 3½ million persons.

The reason is simply that each farmer today can produce far more than his predecessors. A modern corn farmer, for instance, will use 6-row or 8-row field equipment, including tractors, costing a total of about $22,000, trucks and field implements costing about $18,000, a self-propelled combine harvester worth $18,000, and grain drying equipment valued at about $18,000. To make this high-capacity equipment profitable, he may need to grow 600 to 1,000 acres of corn. His father, using 2-row equipment, probably earned a good living from 320 acres. His grandfather, using horsedrawn equipment, could work only about 120 acres.

There has been a vast reduction in the man-hours needed to produce most of the major farm commodities. It used to take 135 man-hours to produce 100 bushels of corn in 1910; today it takes 7 hours. Man-hours needed to produce 100 bushels of wheat dropped from 106 to 9 in the same period. It took 31 hours to produce 100 pounds of turkey in 1910 but takes only 1.1 today.

OPPORTUNITIES ON FARMS

Since the demand for farm products is growing much more slowly than productivity, the number of opportunities in farming is declining steadily. The increasing productivity of our farmers has been a boon to consumers and the nonfarm economy—but today farmers find themselves in an industry that requires ever-larger farms, more investment, and better management to stay in business.

Management is the key to success in modern farming. Today's farmer needs a much higher level of knowledge and skills than his predecessor. For example, the dairy farmer used to feed each cow an amount of grain based on the amount of milk she had produced the previous day or week. The modern dairyman feeds his cows on the basis of their *potential*—"pushing" potential high-performance cows to their limits, cutting back on expensive feed for cows that already have peaked out. Figuring the potential is a much more difficult technique than weighing milk.

Similar management problems face the modern farmer in most areas—which is why college training is becoming the rule rather than the exception for the young commercial farmer. It gives him the technical basis he needs to keep up with research and technology and to apply them intelligently on his own farm. Biology, engineering, soil science, and agronomy—not to mention economics and accounting—are part of the necessary kit of tools for a successful farmer today.

Capital requirements are another barrier the beginning farmer must over come. The average commercial farm in 1969 had 550 acres, with a value of more than $100,000 in land and buildings alone. Regionally, the value of commercial farms vary from an average of $46,000 in Appalachia to nearly $300,000 in the Pacific region.

For the person who has the training, the capital, and the management ability, the modern farm can offer much higher incomes than the old-style farm ever did.

About 210,000 farms in the United States sold $40,000 worth of farm products or more during 1969. These large farms averaged $37,503 in net income. Another 357,000 farms sold an average of $20,000 to $39,999 worth of farm products in 1969. These medium-sized farms averaged $10,466 in net income.

Together, these two groups—the large and medium sized—make up nearly 20 percent of U.S. farms and accounted for nearly 72 percent of U.S. farm sales in 1969. These two groups represent the expanding sector of U.S. agriculture.

Although an additional one-half million farms had gross sales of $10,000 to $19,999 in 1969, these small sized farms averaged only $6,481 in net income. Most of these farm owners would need to expand their operations or else supplement their incomes with off-farm work to equal the income they could get in some other type of employment.

Agriculture still offers challenging and rewarding careers, with larger incomes and better living conditions than it used to—but it offers them to fewer and fewer people.

Many people, of course, prefer living in the country, and modern transportation and communications, public services, and household and farming appliances have eliminated most of the disadvantages that attended rural living a generation or two ago.

Although the number of opportunities in farming is shrinking, the number of jobs in farm-related industries that supply products and services to the farmer and which handle marketing activities for farm products. They have a continuing need for young people who have a farming background—plus training for their specialized functions.

Training Opportunities Available for Farming

A good initial background in farming is obtained by growing up on a farm. Necessary experience also may be gained by working as a closely supervised tenant or hired worker on a successful farm. College training in agriculture and in agricultural business management are of substantial value to the modern farmer.

Several types of vocational training are available under federaly assisted programs of vocational education. Training is offered in the following ways:

1. High school courses in agriculture are taught by teachers who are agricultural college graduates.
2. Short courses for young farmers at schools of agriculture, including intensive training in farm planning, farm structures, construction, welding and related shop and repair work, as well as instruction in crop production, livestock feeding and management, record keeping, and other aspects of farming.
3. Adult farmer programs in evening classes (or day classes in off-seasons) providing intensive instruction in subjects such as land and soil management, crop and livestock production, new technology and equipment, and financial management.

The most significant general

sources of information and guidance available to farmers are the services provided by the land-grant colleges and universities and the U.S. Department of Agriculture. These services include research, publications, teaching, and extension work. The county agricultural agent is often the best contact for the young person seeking advice and assistance in farming. The Farmers Home Administration system of supervised credit is one example of credit facilities combined with a form of extension teaching. Organized groups, such as the Future Farmers of America and the 4-H Clubs, also furnish valuable training to young farm people.

OPPORTUNITIES ON SPECIFIC TYPES OF FARMS

Although the number of farms and farm jobs are decreasing, desirable and rewarding opportunities occur from time to time in agriculture and related pursuits. The decision to enter farming may be made simply because an opening exists on the family farm or on a farm nearby. To be successful, a young man should appraise carefully the requirements in specific types of farm operations, and the prospects for success in them, taking into consideration his aptitude, interests, preferences, experience, knowledge, and skills in directing labor and handling livestock and machinery. He also must consider his family labor supply and his financial resources, as the labor and capital requirements for an operation of adequate size vary widely from one type of farm to another.

A realistic decision to go into farming can be made only in terms of a particular area or community. This section evaluates, from an occupational standpoint, some of the more common farm types. The accompanying table gives illustrative data on size of farm, capital requirements, and net farm incomes received by operators of typical or representative farms in various parts of the country. Many farms are larger than these and offer more return than is shown here. Some are smaller and offer the operator little income or opportunity to improve his status without major changes. On most of the farms, the major part of the work is done by the farm operator and his family. Whereas, some of the smaller farms hire workers only during the peak labor season, large ones often use hired labor the whole year.

The figures in the table on capital invested mean that the operator controls or uses resources valued at that amount. Many farmers supplement their own capital with borrowed funds; others rent part or all of the land they use, thus allowing more of their funds for the purchase of livestock, feed, machinery, and equipment. Still others have partners who provide most of the working capital. For example, many farmers who raise broilers are in partnership with a feed dealer.

No brief general statement can be made about specialization versus diversification in farming operations that would apply in all parts of the country. The general trend is for more specialized farming. Farms that produced many products a generation ago now may produce only two or three. Efficient production of most farm products requires a substantial investment in specialized equipment. If the farm operator is to receive the full benefit from his investment, he must produce on a large scale. Two other factors contributing to specialization are the increased emphasis on quality of farm products, and the greater knowledge and skill required for effective production. Few farmers, however, find it advantageous to produce only one product. The main reasons for producing more than one product are the desirability of spreading price and production risks, the more effective use of labor (particularly family labor), and the fuller utilization of most other resources than can be realized in a one-product system.

Dairy Farms

Dairy farms are common in most parts of the country. Despite modern methods of processing and transporting milk, production is still concentrated near the large population centers particularly in the Northeast and the Great Lakes States. However, many areas in the Far West and the South are becoming large producers of dairy products. Many of the newer type large dairy farms are "drylot" or barn operations with little or no pasture land. Some are cooperatively operated units. However, on typical dairy farms in the Lake States, and to a lesser extent in the Northeast, crops are important, often requiring operators to hire or exchange labor at harvest time. There is work every day throughout the year on dairy farms, so that effective use can be made of labor, and a regular force can be occupied most of the time.

Although most people do not like to be "tied down" 7 days a week, this obstacle presents no great hardship for the man who enjoys working with cattle. Dairying is also a good choice for the man who likes to work with mechanical equipment. Dairy farmers who produce much of their own feed find variety in the many different jobs that must be done.

The dairyman's sales and income are distributed evenly throughout the year. Moreover, the prices he receives are less subject to year-to-year fluctuations than are prices received by operators in most other types of farming. The accompanying table shows the average net farm income on dairy farms in central and southeastern Wisconsin for 1968–69.

Compared with farmers in most other areas, dairy farmers in the more concentrated milksheds of the Northeast (such as the dairy farms in the Central Northeast shown in the table) generally have larger herds, purchase a larger proportion of their feed, and buy rather than raise their herd replacements. In the most highly specialized producing area near Los Angeles, dairy farms are drylot operations. They are quite small in acerage but large in milk production and number of cows milked. No crops are produced; these dairy operators buy their entire feed requirements from outside the area. Most of the cows are bought at freshening time and are replaced when their lactation period is completed.

Net farm income represents the return to the farm operator and his family for their labor and the capital invested in the farm business—provided the operator owns his land and is free from debt. If he rents part or all of his farm, not all of net farm income is available for family living; part of it must be used for rent. Similarly, the farmer who is in debt must deduct interest costs and payments on the principal.

Livestock Farms and Ranches

A general livestock farm is a good choice for the farmer who is interested and skilled in working with livestock and mechanical equipment. Many farmers prefer general livestock farms—such as the hog-beef feeding farms in the Corn Belt (see table)—because in much of the year they require fewer chores than dairy farms. The timing of daily hog and beef cattle chores also is more flexible than the milking schedule on dairy farms. Practically all of the regular labor on most general livestock farms is provided by the operator and his family. During some seasons of the year, there is full-time or part-time work for several members of the family, but there are usually slack labor periods when there is time for leisure or nonfarm activities.

The livestock farmer's income is not as well distributed throughout the year as the dairyman's, and it is less likely to be uniform from year to year. Financial and management problems result, increasing the risks of operation. Moreover, on farms of limited acerages—often found in the Eastern States—the level of income from general livestock farming is usually lower than from a dairy herd on similar acreage.

Most hog producers have their own breeding stock and raise the pigs they fatten for market. Some farmers who fatten cattle and sheep also raise their calves and lambs. But most of the cattle and sheep fattened and marketed by the livestock farmer are bred and raised originally by someone else—usually the livestock rancher of the West. The accompanying table includes data for four types of Western livestock operations: Northern Plains and Northern Rocky Mountain cattle ranches, sheep ranches in Utah, Nevada, and cattle ranches in the Southwest. In these areas of low rainfall, the main source of feed is range grass, and several acres are required to support one animal. Large acreages are required to provide enough pasture for their stock; ranchers spend much of their time in the saddle, truck, or jeep managing their herds. Much of this range comes from the public domain. Except where irrigation is available, feed crops usually are not grown.

Poultry Farms

One-third of the farmers in the United States raise some poultry, but in 1964, fewer than 3 percent were classified as poultry farmers. Many poultry farms concentrate on egg production. Most of the larger and more specialized of these farms are in the southeast, northeast and in California; others produce broilers. Many highly concentrated centers of broiler production are east of the Mississippi River, and a few are on the West Coast. Turkey producers also are specialized. A concentration of specialized producers of ducks is located in Suffolk County, Long Island, New York.

Very few poultrymen produce crops for sale. They purchase special poultry feeds and laying mash. Crops are not grown by most specialized poultry producers, particularly those who produce broilers or large laying flocks. Commercial poultry farmers in New Jersey, for example, buy all their feed. The typical broiler producer in Maine, the Delmarva (Delaware, Maryland, Virginia) peninsula, and Georgia devotes almost all of his capital and labor to the production of broilers.

Poultry farming requires specialized skill in handling birds, chiefly on the part of the operator. Bulk handling of feed and mechanical feeding is widespread and requires little physical strength. For these reasons, poultry farms make considerable use of family help.

Data on average capital investment and net farm income for representative egg producers in New Jersey and broiler operators in Georgia for 1968–69 are given in the table. These averages do not reveal the sharp year-to-year fluctuations in income that occur. Because they have a high proportion of cash costs and a thin margin of profit, relatively small changes in prices of feed, broilers, and eggs can bring about sizable fluctuations in net farm income.

The incomes of most broiler producers, however, are fairly sta-

Size of farm, capital invested, and net farm income on commercial farms, by type, and location, 1968–69 average

Type of farms and location	Size of farm as measured by	Capital invested in —					Net farm income[1]
		Land and buildings	Machinery and equipment	Livestock	Crops	Total	
Dairy farms:							
Central New York	40 milk cows	$ 37620	$17150	$18840	$ 6120	$ 79730	$14372
Southeastern Wisconsin	40 milk cows	63300	18090	17630	9050	108070	18669
Egg-producing farms, New Jersey	5550 layers	43320	2730	8330	0	54380	10592
Broiler farms, Georgia	44,600 produced annually	21640	4940	860	160	27600	1973
Corn Belt farms:							
Hog-beef feeding	280 acres of cropland	142400	18750	40000	19000	220150	22944
Cash grain	375 acres of cropland	278000	30000	0	2000	310000	19000
Cotton farms:							
Mississippi Delta	900 acres of cropland	453750	76450	0	0	530200	48700
Southern High Plains, Texas							
Irrigated	870 acres of cropland	413700	41000	0	0	454700	20350
Nonirrigated	860 acres of cropland	193750	16100	0	0	209850	20950
Tobacco farms, Coastal Plan, North Carolina	50 acres of cropland	43860	5520	680	690	50750	5888
Tobacco-livestock farms, Bluegrass area, Kentucky	64 acres of cropland	123000	7020	10520	2280	142820	10998
Wheat-fallow farms:							
Northern Plains	1800 acres of cropland	172000	42000	0	0	214000	8312
Southern Plains	1800 acres of cropland	227000	35000	0	0	262000	6698
Pacific Northwest	1800 acres of cropland	338000	50000	0	0	388000	13007
Cattle ranches:							
Northern Plains	308 beef cows	315690	18760	78580	5050	418080	22668
Northern Rocky Mountain	307 beef cows	209200	17840	68280	10220	305540	22242
Southwest	306 beef cows	423170	11610	65670	0	500450	9700
Sheep ranches, Utah-Nevada	2025 breeding ewes	129260	13600	66220	2100	211180	19750

[1] The information presented here is on an owner-operated basis, primarily for comparability between types of farms. Net farm income is the return to operator and unpaid members of the family for their labor and management on the farm and return to total capital. No allowance has been made for payment of rent, interest or mortgage.

Note: Prepared in the Farm Production Economics Division, Economic Research Division, U.S. Department of Agriculture.

ble because they produce "under contract." Contract production is more widespread in broiler production that in any other major type of farming. Under these arrangements, the financing agency (usually a feed dealer) furnishes the feed, chicks, and technical supervision—almost everything except the buildings, equipment, and the direct production labor. The grower receives a stipulated amount per 1,000 birds marketed, and often a bonus for superior efficiency. Many turkey producers operate under similar contracts, but these arrangements are not nearly so universal for the production of turkeys as for broilers.

Corn and Wheat Farms

For the man who likes working with crops and farm machinery, cash grain farming (growing soybeans, corn or wheat) has much to offer. Many people dislike being tied down with daily responsibilities the year around, as with livestock chores. They prefer, instead, to work long days with large laborsaving equipment during the busy seasons, as in soil preparation, planting, and harvesting, and then to have some free time in slack periods.

The table shows the investment required and the recent income experience of some representative cash grain farms. Farms of this type include cash grain farms in the Corn Belt, spring wheat-fallow farms in the Northern Plains, winter wheat-fallow farms in the Southern Plains, and wheat-fallow farms in the Pacific Northwest. Some of these farms—particularly in the Northern Plains—raise some beef cattle for sale as feeders, and a small number keep a few milk cows. However, this livestock production is usually of secondary importance. Many of these cash crop farmers do not raise any livestock.

Two of the main risks faced by the commercial wheat grower are unfavorable weather and low prices. However, crop insurance has reduced the risk of low yields, and Government price support programs have lessened the risk of low prices.

Cotton, Tobacco, and Peanut Farms

In terms of number of farmers, the production of cotton, tobacco, and peanuts makes up a large part of the agriculture in the Southeastern and South Central States. These products are grown on farms that range from very small operating units to comparatively large ones. Market competition in these crops has been keen, and many growers have been forced to diversify and enlarge their farms—adjustments which require capital investment. Competition from cotton growers in the irrigated areas of the West and Southwest have forced many farmers in the Southeast to discontinue cotton production. Some of them have diversified their operations, and others have found better opportunities in Southern Industrial expansion.

Crop Specialty Farms

Many farmers throughout the country have unique background, skills, resources, or other advantages for particular kinds of farming chiefly because of their location, home training, or neighborhood practices. They may specialize in the production of a single crop—such as grapes, oranges, potatoes, sugarcane, or melons—or a combination of related specialty crops.

Operators of these enterprises usually employ many seasonal workers and require relatively expensive specialized equipment. They need specific skills many of which can be obtained only through experience. Enterprises of this kind should be under taken only by persons with considerable experience and some of the special skills and techniques required. An individual having an aptitude for these skills usually can learn them by working a few years as a hired hand on such a specialty farm or as a tenant for a landlord who can give direction and assistance.

Annual returns from these specialty farms usually vary greatly from year to year because of the vagaries of nature and the changes in prices. Operators of these farms who keep abreast of production and marketing conditions are usually well rewarded for their ability to manage, produce, and market their products.

Private Outdoor Recreation Farms

Public demand for outdoor recreation is far in excess of the existing and projected supply of public facilities. The public sector is not flexible enough to supply the specialized types of recreation or services demand by smaller groups. The privately owned outdoor recreation enterprise, particularly the farm-base type, is in a unique position to supply these types of recreation services and activities to the public.

The 1964 Census of Agriculture reported over 3 million farms in the United States. Of this total, about 28,000 earned money from some type of recreation activity.

Many farm operators in the vicinity of national, State, and local parks, or near wildlife reservations have taken advantage of the location in establishing recreation businesses. The average amount received from this activity was about $1,500 per farm reporting.

These farmers sell hunting or fishing rights to individuals, form hunting clubs, or establish private campgrounds. They absorb the overflow from public campgrounds or cater to the individuals who want more privacy in their camping. Vacation farms cater to family groups during the summer and allow hunting later in the year when children are in school. Many farmers enlarge and improve their ponds or irrigation reservoirs. They stock ponds for fishing and have swimming areas in the summer and skating areas in the winter. Old farm buildings, sheds, and barns are converted into riding stables or horse boarding stables, or a combination of both. Shore and backwater areas are used to dock privately owned craft. In so doing, many farmers have converted a liability into an asset. Farmers become guides for hunter during the game season and mechanics and service engineers for watercraft. Guides are also in demand for nature trails and scenic tours.

Other Specialties

Other highly specialized operations, such as fur farms, apiaries, greenhouses, nurseries, and flower farms, require special knowledge and skilled management. Special skills and equipment are required, and risks are high. Even with the high risk, from the standpoint of capital invested and income, the venture is often rewarding to individuals who have the ability and the resources.

Sources of Additional Information

Additional information may be obtained from the U.S. Department of Agriculture, Washington, D.C. 20250; the Department of Commerce, Washington, D.C. 20230; and from State Land Grant Colleges and Universities.

OCCUPATIONS RELATED TO AGRICULTURE

Because of the increased scale and complexity of modern farming, farmers are buying a greater range and volume of production inputs and services from off-farm sources. Thus, larger numbers of people are needed in occupations related to agriculture. These occupations are many and diverse and offer a wide range of choice to the person who is interested in agriculture but does not have the opportunity, resources, or desire to enter agriculture directly. The salary range in occupations related to agriculture varies widely, depending on education, experience and type of job. Salaries of $10,000 a year or more are not uncommon. The professional and technical vocations usually require college training; however, other vocations may be learned on the job. Some of these occupations are discussed below.

COOPERATIVE EXTENSION SERVICE WORKERS

(D.O.T. 096.128)

Nature of the Work

Extension Service workers are engaged in educational work in agriculture, home economics, youth activities, and community resource development. They are employed jointly by State landgrant universities and the U.S. Department of Agriculture. Extension workers must be proficient in both subject matter and teaching methods.

Extension workers help people analyze and solve their farm and home problems and aid in community improvement. Much of this educational work is carried on in groups, through meetings, tours, demonstrations, and local voluntary leaders. Individual assistance is given on problems that cannot be solved satisfactorily by group methods. Extension workers rely heavily on mass communication media such as newspaper, radio, and television.

County extension workers help farmers produce higher quality crops and livestock more efficiently and assists them in developing new market outlets and in planning production to meet market demands, including quality standards and varieties. This also helps community leaders to improve the community and to plan and provide for economic development, recreation, and more adequate public facilities such as schools, water supply and sewer systems, and libraries. They assist homemakers to provide more family enjoyment from existing resources, a higher level of nutrition, and a more pleasant home environment. Some extension workers help youth to become more useful citizens and gain more personal satisfaction through programs in career selection, recreation, health, and leadership. The essence of extension work is to help people help themselves to achieve the goals they think are important.

County extension workers are supported by State Extension Specialists. Their job is to keep abreast of the latest research in their particular field of interest, interpret this for use in extension programs, and assist county extension workers in developing educational programs, activities and events to demonstrate use of this new knowledge.

Cooperative Extension Services employ persons with a wide range of skills. Extension staffs include people skilled in all phases of crop and livestock production, conservation, environmental improvement, farm management and marketing, family living, human development, nutrition, home management, child development, sociology, psychology, veterinary medicine, engineering, textiles and clothing, resource economics, and business and public administration.

Places of Employment

Extension workers are located in county offices, area offices serving multi-county units, and State offices which are usually located on the campus of the land-grant college or university.

Agents are located in nearly every county in the 50 States, Puerto Rico, and the District of Columbia. The county staffs range in size from one agent serving a wide variety of clientele interests to staffs of a dozen or more specialized agents in counties with high-density population and great diversity of interests. Staffs are located in countries ranging from the most rural to the most urban.

Training and Other Qualifications

Cooperative Extension agents assigned to counties are required to be proficient in a discipline related to the needs and programs of the clientele with whom they work. They must have a B.S. degree in their subject-matter, and some training in educatical techniques is desirable.

Often they receive training in extension techniques in a pre-induction training program and are upgraded through regular in-service training programs in both educational techniques and the subject-matter for which they are responsible. In addition to subject-matter proficiency and extension techniques, successful extension workers must like to work with and to help people.

In most States, specialists and agents assigned to multicounty and State staff jobs are required to have at least one advanced degree and many must have the Ph. D.

Employment Outlook

Extension services employ more than 15,000 professional people. The demand for additional workers is expected to continue, especially in depressed rural areas. As agricultural technology becomes more complicated, and as farm people become more aware of the need for organized activity, more help will be sought from trained Extension Service personnel. The Extension Service also is being extended to new segments of the population, as residents recognize the value of their assistance, particularly in helping the disadvantaged.

Counterparts of the Cooperative Extension Service are being established in many countries, and Extension Service personnel often are recruited to help initiate and organize these programs.

Earnings and Working Conditions

The salaries of extension workers vary from State to State and county to county. In the main, however, they are fully competitive with similar jobs in industry and government. Generally speaking, the career ladder for extension workers proceeds from assistant county agent to more responsible jobs within that county, or in another county in the State, to assignments on the State extension staff.

Sources of Additional Information

Additional information may be obtained from county extension offices, the State Director of the Cooperation Extension Service located at each land-grant university; or the Extension Service, U.S. Department of Agriculture, Washington, D.C. 20250.

SOIL SCIENTISTS

(D.O.T. 040.081)

Nature of the Work

Soil scientists study the physical, chemical and biological characteristics and behavior of soils. They investigate the soils both in the field and in the laboratory and grade them according to a national system of soil classification. From their research, scientists can classify soils in terms or of response to management practices and capability for producing crops, grasses, and trees, as well as in terms of their utility as engineering materials and foundations for buildings and other structures. Soil scientists prepare maps, usually based on-aerial photographs, on which they plot the individual kinds of soil and other landscape features significant to soil use and management in relation to land lines, field boundaries, roads, and other conspicuous features.

Soil scientists also conduct research to determine the physical and chemical properties of soils and their water relationships, in order to understand their behavior and origin. They predict the yields of cultivated crops, grasses, and trees, under alternative combinations of management practices.

Soils science offers opportunities for those who wish to specialize in soil classification and mapping, soil geography, soil chemistry, soil physics, soil microbiology, and soil management. Training and experience in soil science also will prepare persons for positions as farm managers, land appraisers, and many other professional positions.

Places of Employment

Most soil scientists are employed by agencies of the Federal Government, State equipment stations, and colleges of agriculture. However, many are employed in a wide range of other public and private institutions, including fertilizer companies, private research laboratories, insurance companies, banks and other lending agencies, real estate firms, land appraisal boards, State highway departments, State conservation departments, and farm management agencies. A few are independent consultants, and others work for consulting firms. An increasing number are employed in foreign countries as research leaders, consultants, and agricultural managers.

Training and Advancement

Training in a college or university of recognized standing is important in obtaining employment, as a soil scientist. For Federal employment, the minimum qualification for entrance is a B.S. degree with a major in Soil Science or in a closely related field of study, and having 30 semester hours of course work in the biological, physical, and earth sciences, including a minimum of 15 semester hours in soils. Those having graduate training—expecially those with the doctor's degree—can be expected to advance rapidly into a responsible and high paying position. This is particularly true in soil research, including the more responsible positions in soil classification, and in teaching. Soil scientists who are qualified for work with both field and laboratory data have a special advantage.

Many colleges and universities offer fellowships and assistantships for graduate training or employ graduate students for part-time teaching or research.

Employment Outlook

The demand is increasing for soil scientists to help complete the scientific classification and evaluation of the soil resources in the United States. One of the major programs objectives of the Soil Conservation Service of the U.S. Department of Agriculture is to complete the soil survey of all rural lands in the United States.

This program includes research, soil classification and correlation, interpretation of results for use by agriculturists and engineers, and training of other workers to use these results. Also, demand is increasing for both basic and applied research to increase the efficiency of soil use.

Earnings

The incomes of soil scientists depend upon their education, professional experience, and individual abilities. The entrance salary in the Federal service for graduates having a B.S. degree was $6,938 since January 1971. They may expect advancement to $8,522 after 1 year of satisfactory performance. Further promotion depends upon the individual's ability to do high-quality work and to accept responsibility. Earnings of well-qualified Federal soil scientists with several years experience range from $12,615 to $20,815 per year.

Sources of Additional Information

Additional information may be obtained from the U.S. Civil Service Commission, Washington, D.C. 20415: Office of Personnel, U.S. Department of Agriculture, Washington, D.C. 20250; or any office of the Department's Soil Conservation Service.

Also see statements on Chemists and Biologists.

SOIL CONSERVATIONISTS

(D.O.T. 040.081)

Nature of the Work

Soil conservationists supply farmers, ranchers, and others with technical assistance for soil and water conservation. Farmers and other land managers use this technical assistance in making adjustments in land use; protecting land against soil deterioration; rebuilding eroded and depleted soils; stabilizing runoff and sediment-producing areas; improving cover on lands devoted to crop raising, forest, pasture, range, and wildlife; conserving water for farm and ranch use and reducing damage from flood water and sediment; and in draining or irrigating farm or ranches.

The types of technical services provided by soil conservationists are as follows: Maps presenting inventories of soil, water, vegetation, and other details essential in conservation planning and application; information on the proper land utilization and the treatment suitable for the planned use of each field or part of the farm or ranch, groups of farms or ranches, or entire watersheds; and estimates of the relative cost of, ranches, or entire watersheds; and estimates of the relative cost of, and expected returns from, various alternatives of land use and treatment.

After the landowner or operator decides upon a conservation program that provides for the land to be used within its capability and treated according to the planned use, the conservationist records the relevant facts as part of a plan which, together with the maps and other supplemental information, constitute a plan of action for conservation farming or ranching. The soil conservationist then gives the land manager technical guidance in applying and maintaining the conservation practices.

Where Employed

Most soil conservationists are employed by the Federal Government, mainly by the U.S. Department of Agriculture's Soil Conservation Service and by the Department of the Interior's Bureau of Indian Affairs. Some are employed by colleges and State and local governments; others by banks and public utilities.

Training and Advancement

A Bachelor of Science degree with a major in soil conservation or one of the closely related natural science or agricultural fields, and having 30 semester hours in fields of natural science or agriculture, including the equivalent of a 3-semester-hour course in soils, constitute the minimum requirement for professional soil conservationists. Those who have unusual aptitude in the various phases of the work have good chances of advancement to higher salaried technical administrative jobs.

Employment Outlook

Employment opportunities for well-trained soil conservationists are good. Opportunities in the profession will expand because government agencies, public utility companies, banks, and other organizations are becoming interested in conservation and are adding conservationists to their staffs. Other new openings will occur in college teaching, particularly at the undergraduate level. In addition, some openings will arise because of the normal turnover in personnel.

Earnings

Since January 1971, soil conservationists having a bachelor's degree and employed by the Federal Government received $6,938 a year. Advancement to $8,582 could be expected after 1 year of satisfactory service. Further advancement depends upon the individual's ability to accept greater responsibility. Earnings of well-qualified Federal soil conservationists with several years' experience range from $12,615 to $20,815 a year.

Sources of Additional Information

Additional information on employment as a soil conservationist may be obtained from the U.S. Civil Service Commission, Washington, D.C. 20415; Employment Division, Office of Personnel, U.S. Department of Agriculture, Washington, D.C. 20250; or any office of the Department's Soil Conservation Service.

OTHER PROFESSIONAL WORKERS

Nature of the Work

The discussion that follows deals primarily with job categories that are generally termed professional fields. These occupations generally require at least a bachelor's degree, and master's and Ph. D. degrees are becoming increasingly valuable both from the standpoint of salary and of executing the functions required on the job. Some of these jobs are discussed more fully elsewhere in the *Handbook*. (See index.)

Agricultural economists (D.O.T. 050.088) deal with problems related to production, financing, pricing, and marketing of farm products both in the United States and in several foreign countries. They are factfinders, evaluators, analysts, and interpreters who provide economic information to farmers, policymakers, and other interested persons. They provide cost-benefit analyses for evaluating farm programs at the National, State, and farm level. They study the effects of mechanization, technological advances, and other developments that influence the supply and demand for farm products and its accompanying effects on costs and prices of farm products.

Agricultural engineers (D.O.T. 013.081) develop new and improved farm machines and equipment, deal with the physical aspects of soil and water problems in farming; design and supervise installation of irrigation systems, watershed protection, flood prevention, and related works; devise new techniques for harvesting and processing farm products; and design more efficient farm buildings.

Agronomists (D.O.T. 040.081) are concerned with growing, breeding, and improving field crops such as cereals and grains, legumes and grasses, tabacco, cotton, and others. They also do research in the fundamental principles of plant sciences and study and develop seed propagation and plant adaption.

Animal physiologists and animal husbandmen (D.O.T. 040.081) study and do research in the environmental influences in relation to efficient management of farm animals; they also are concerned with the breeding, growth, nutrition and physiology of livestock.

Veterinarians (D.O.T. 073.081) inspect livestock at public stockyards and points of entry into the U.S.; inspect establishments that produce veterinary biological supplies; administer tests for animal diseases; conduct programs for the control and eradication of animal disease; research livestock diseases and vaccines for disease control; work directly with farmers in protection or restoration of livestock health; and provide services for the care of small animals and pets. (See statement on veterinarians elsewhere in the Handbook for additional information.)

Geneticists (D.O.T. 041.081) try to develop strains, varieties, breeds, and hybrids of plants and animals that are better suited than those presently available for the production of food and fiber.

Microbiologists (D.O.T. 041.081) study bacteria and the relation of other micro-organisms to human, plant, and animal health and the function of these micro-organisms in the making of products such as vitamins, antibiotics, amino acids, sugars, and polymers.

Plant scientists (D.O.T. 041.081) study plant diseases and their nature, cause, and methods of control. They also study the structure of plants and the growth factors in plants. Methods of improving fruits, vegetables, flowers, and ornamentals, and means by which improvements may be made by better management, environment, and propagation are also of major concern.

Plant quarantine and plant pest control inspectors (D.O.T. 041.081) who are trained in the biological sciences, supervise and perform professional and scientific work in enforcing plant quarantine and pest control laws. Plant Quarantine Inspectors inspect ships, planes, trucks, and autos coming into the country to keep out dangerous insect pests. Plant Pest Control Inspectors conduct programs to protect the crops of the country by prompt detection, control, and eradication of plant pests.

Entomologists (D.O.T. 059.088) study insects, both beneficial and harmful to farming. They are concerned particularly with identifying the populations and distributions of insects that injure growing crops and animals; harm human beings; and damage agricultural commodities during shipping, storage, processing, and distribution. These concerns are involved particularly toward finding means by which these insects may be controlled.

Foresters (D.O.T. 040.081) are concerned with the protection, production, processing, and distribution of our timber resources. They also study means by which wood may be seasoned, preserved, and given new properties.

Human nutritionists (D.O.T. 077.128) study the means by which the human body utilizes food substances.

Rural sociologists (D.O.T. 054.088) study the structure and functions of the social institutions (customs, practices, and laws) that are a part of and or affect rural society.

School teachers (D.O.T. 041.081) in vocational agriculture and related fields supervise and give instructions in farm management, communications, mechanics, engineering, and related fields.

Farm managers, including agriculture management specialists, supervise and coordinate the production, marketing, and purchasing and credit activities of one farm or a group of farms.

Places of Employment

Persons trained in these specialties work in various capacities that relate to agriculture. Government agencies, colleges, agricultural experiment stations, and private businesses that deal with farmers hire many research workers. They also hire people to take technical and administrative responsibilities in public agencies involving farmers or programs affecting farmers. Agribusiness and farmer cooperatives, private business, commercial, and financial companies that buy from, sell to, or serve farmers also employ many people. State, county, and municipalities hire many who serve as vocational agriculture teachers and workers in agricultural communications, in farmers' organizations, or in trade associations whose members deal with farmers.

The number of research activities related to agriculture has increased very rapidly. The largest agencies in this field are the State agricultural experiment stations connected with the land-grant colleges and the various research branches of the U.S. Department of Agriculture. Such agricultural specialists work for other research organizations in independent research, and in companies that finance farming operations, market farm products, or produce chemicals, equipment, and other supplies or services for farmers. The U.S. Department of Agriculture employs workers in research positions in various parts of the country: in Washington, D.C., at the Agricultural Research Center at Beltsville, Md.; and at land-grant colleges. Other Government departments also have many agricultural research jobs.

Various independent research organizations, foundations, and private business groups in many parts of the country recently have initiated research related to agriculture. They tend to be located either in industrial centers or in areas of high agricultural activity, and include producers of feed, seed, fertilizer, and farm equipment; and of insecticides, herbicides, and other chemical dusts and sprays.

Public and private lending institutions, which make loans to farmers, employ men with broad training in agriculture and business. These workers ordinarily are required to have had practical farm experience, as well as academic training in agriculture, economics, and other subjects. Making financially sound loans involves careful analysis of the farm business and proper evaluation of farm real estate and other farm property. These workers are employed by the cooperative Farm Credit Administration in its banks and in associations operating under its supervision throughout the country; by the Farmers Home Administration in its Washington, State and county offices throughout the country; by rural banks; and by insurance companies that have substantial investments in farm mortgages.

The Federal and State Governments also employ various specialists in activities relating to agriculture. These specialists have technical and managerial responsibilities in activities such as programs relating to the production, marketing, inspection, and grading of farm products; prevention of the spread of plant pests, animal parasites, and diseases; and management and control wildlife.

Large numbers of professionally trained persons are employed by cooperatives (businesses owned and run by the farmers) and business firms that deal with farmers. Employment in these organizations may be expected to expand, as farmers rely increasingly on them to provide farm supplies, machinery, equipment, and services, and to market farm products. The size of the organization and the types of services it offers determine the number of its employees and the nature of their jobs. Large farm supply cooperatives and businesses, for example, may have separate divisions for feed, seed, fertilizer, petroleum, chemicals, farm machinery, public relations, and credit, each supervised by a department head. In smaller businesses and cooperatives, such as local grain-marketing elevators, the business is run almost entirely by the general manager who has only two or three helpers.

Agricultural communications is another expanding area of specialization. Crop reporters and market news reporters are employed by the U.S. Department of Agriculture in field offices throughout the United States. Crop reporters gather information on crop production during all stages of the growing season. Market news reporters collect information on the movement of agricultural produce from the farm to the market. Radio and TV farm directors are employed by many radio and TV stations to report prices, sales, grades, and other agricultural information to farm people. Agricultural reporters and editors compile farm news and data for farm journals, bulletins, and broadcasts. Closely related to agricultural communications is employed in farmers' organizations or in trade associations whose members deal with farmers.

The Nationwide, federally aided program of vocational education offers employment for persons technically trained in agriculture and related subjects. Teachers of vocational agriculture not only teach high school students interested in farming, but provide organized instruction to assist young farmers in becoming satisfactorily established in farming and in becoming community leaders. They also provide organized instruction for adult farmers, giving individual consultation on their farms to keep them abreast of modern farm technology.

The qualifications of workers in all of these fields ordinarily include a college education and special training in a particular line of work. In most of these fields, the demand for workers exceeds the supply. In recent years, the demand has been increased because of the need to recruit professional personnel to staff agricultural missions and to give technical aid to agricultural institutions and farmers in other countries.

Sources of Additional Information

Opportunities in Research. Additional information on research opportunities at land-grant colleges may be obtained from the dean of agriculture at the State land-grant college. Information on employment in the U.S. Department of Agriculture is available from the USDA recruitment representatives at land-grant colleges and from the Office of Personnel, U.S. Department of Agriculture, Washington, D.C. 20250.

The following publications will be valuable:

"Profiles-Careers in the U.S. Department of Agriculture," U.S. Department of Agriculture, October 1968. Superintendent of Documents, Washington, D.C. 20402. Price $3.25.

"Rewarding Careers in the Dynamic Industry—Agriculture." American Association of Land-Grant Colleges and State Universities, Washington, D.C. 1966. Copies can be obtained free from your State Agricultural College.

Opportunities in Agricultural Finance. Inquiries on employment opportunities in agricultural finance may be directed to the following:

Farm Credit Administration, Washington, D.C. 20578.

Farm Credit District—Springfield, Mass.; Baltimore, Md.; Columbia, S.C.; Louisville, Ky.; New Orleans, La.; St. Louis, Mo.; St. Paul, Minn.; Omaha, Nebr.; Wichita, Kans.; Houston, Tex.; Berkeley, Calif.; Spokane, Wash.

Farmers Home Administration, U.S. Department of Agriculture, Washington, D.C. 20250.

Agricultural Director, American Bankers Association, 90 Park Ave., New York, N.Y. 10016.

Opportunities with Cooperatives. About 22,000 cooperatives serve rural people in every area of the United States. These include marketing and farm supply cooperatives, rural electric telephone associations, rural credit unions, farm credit cooperatives, mutual irrigation and insurance associations, and artificial breeding associations.

They range from small local cooperatives serving one area to the large regional cooperatives made up of local cooperatives and their farmer members in several States. The locals usually have their headquarters in small towns, the regionals in larger towns or cities. Some regionals hire from 3,000 to 4,000 employees.

Cooperatives in the individual communities are a good source of information on jobs either in their own organizations or in other cooperatives. Most States have a State council or association of cooperatives that can provide information on cooperative locations and some job information.

The Cooperative Foundation, 59 East Van Buren Street, Chicago, Ill., 60605, has a publication, *Careers in Cooperatives.* It describes about 100 different kinds of jobs available in these businesses.

Among the several hundred thousand jobs these cooperatives provide are included:

—Management positions—jobs ranging from managing small local grain elevators to managing cooperatives that do several hundred million dollars worth of business a year.

—Marketing positions—jobs ranging from responsibility for harvesting, transporting, assembling, grading, storing, and selling raw products to processing, packaging, selling, and distributing farm products to retail outlets.

—Farm supply positions—jobs ranging from those in petroleum refineries, and feed mills, or fertilizer manufacturing plants, to those working on the floor of a supply center.

—Farm service positions—jobs such as those of field men who advise farmers on soil, seeds, and fertilizer usage, and who do soil testing; bulk feed deliverymen, machine operators who deliver supplies direct to farms, spread fertilizer on the field, or haul products to market for the farmer.

—Personnel administration positions—jobs such as those of interviewers, position classifiers, counselors, and placement specialists.

—Research positions—jobs covering product development, product testing, quality evaluation of products, and economics research.

—Transportation—jobs such as physical distribution specialists, truck drivers, garage mechanics, traffic managers.

—Office positions—jobs such as secretaries, typists, clerks, receptionists.

Requirements for the jobs vary widely. Some demand college or graduate degrees, others high school education. Still others require no formal educational background but do require basic skills such as those for writing up an invoice or handling a fork lift truck in a warehouse.

Opportunities for Agricultural Economists. For additional information about opportunities in agricultural economics, check with the Department of Agricultural Economics at State land-grant colleges. For information on Federal employment opportunities, applicants may get in touch with USDA recruitment representatives at the State land-grant college or write directly to the Office of Personnel, U.S. Department of Agriculture, Washington, D.C. 20250.

Opportunities as Vocational Agriculture Teachers. As salaries, travel, and programs of vocational agriculture teachers vary slightly among States, prospective teachers should consult the Head Teacher Trainer in Agriculture Education at the land-grant college or the State Supervisor of Agricultural Education at the State Department of Public Instruction in their respective States.

FARM SERVICE JOBS

In almost every type of agriculture, farmers require specialized services which readily can be learned and performed by other workers. A person can enter many of these services, either as an independent operator or as an employee. Some services require an extensive outlay of capital, and others require very little. Some are highly seasonal; others are performed year round. These services and the operation of a small farm can sometimes be combined.

Services that provide year-round employment include the following: Cow testing, artificial breeding, livestock trucking, whitewashing, well drilling, fencing, and tilling.

MINING

The mining industry is a major supplier of the basic raw materials and energy sources required for industrial and consumer use. Metal mines provide iron, copper, gold, and other ores. Quarrying and other nonmetallic mining produce many of the basic materials such as limestone, gravel, and fire clay needed to build the country's schools, offices, homes, and highways. Petroleum, natural gas, and coal are the primary sources of nearly all our energy, both for industrial and personal use. Few products extracted from mines reach the consumer in their natural state. Nearly all require further processing in one of several of the manufacturing industries.

Mining is the smallest major industry division, employing about 620,000 wage and salary workers in 1970. About 43 percent of these workers are employed in the exploration and extraction of crude petroleum and natural gas. Coal mining accounts for about 23 percent of the industry's workers, and quarrying and nonmetallic mineral mining nearly 19 percent. The remaining 15 percent are employed in mining metal ores.

The mining industry employs only a small number of women; most are in clerical positions. As shown in the accompanying tabulation, nearly 70 percent of all workers in mining are employed in blue-collar jobs, primarily as operatives and kindred workers. Included in the operative group are miners and mine laborers; mining machinery operators such as drilling and cutting machine operators, crusher operators, conveyor operators, and oil well drillers; and most other workers engaged in underground mining operations. Also included, and especially important in surface mining, are truck and tractor drivers.

Skilled craftsmen and foremen constitute the second largest occupational group. Mechanics and repairmen maintain the complex equipment and machinery used in mining. Many heavy equipment operators, such as power shovel and grading operators, are employed in open pit mining. Large numbers of pumpers, gagers, and enginemen are needed in the extraction and transportation of petroleum and natural gas. Foremen also constitute an important part of the industry's work force.

The industry's white-collar employees are divided nearly equally among three occupational groups —professional and technical, clerical, and managerial workers. Taken together, these groups make up the remaining three-tenths of the industry's employment. Professional, technical, and kindred workers are concentrated largely in the petroleum and gas extraction industry. Most of them are engineers, geologists, or technicians engaged in exploration and research. Two out of three clerical employees work in the petroleum and gas extraction industry. Most are secretaries, office machine operators, and typists.

Major occupational group	*Estimated employment, 1970 (percent distribution)*
All occupational groups	100
Professional, technical, and kindred workers	12
Managers, officials, and proprietors	8
Clerical and kindred workers	10
Sales workers	1
Craftsmen, foremen, and kindred workers	23
Operatives and kindred workers[1]	46
Service workers	1
Laborers	......

[1] Includes mine laborers.

NOTE: Because of rounding, sums of individual items may not equal total.

Employment in mining is expected to decline slowly through the 1970's, despite increases in output. Increased demand for mining products will be met largely through the use of improved equipment operated by a more highly skilled work force. Even though employment as a whole is expected to decline, different growth patterns are likely within the industry. Employment in coal mining probably will decline more rapidly than employment in metal mining and petroleum and natural gas extraction. Employment in quarrying and nonmetallic mining, on the other hand, is expected to increase.

The statement that follows provides information on employment opportunities in the petroleum and natural gas extraction industry. More detailed information about occupations that are found in mining as well as other industries appear elsewhere in the *Handbook*. (See index in back of book.)

PETROLEUM AND NATURAL GAS PRODUCTION AND PROCESSING

Nature and Location of the Industry

Petroleum is one of the fossil fuels formed from the decay of living matter. It is extracted mainly in the form of crude oil and natural gas.

Many thousands of petroleum companies specialize in a single activity, such as gas or oil exploration or drilling wells. A small number of large integrated firms do much of the petroleum business and provide a large share of the industry's jobs.

This chapter deals with the activities and jobs involved in (1) finding oil and gas and bringing them to the surface of the earth, and (2) converting natural gas to usable products. It excludes petroleum refining, and the transporting and marketing of petroleum products. Occupations in petroleum refining are discussed in a separate chapter in the *Handbook*.

Crude Oil and Natural Gas Production. Because the processes of finding and extracting crude oil and natural gas are the same, jobs involved are similar until the gas or oil well starts producing. In this chapter, "petroleum production" covers the discovery and extraction of natural gas and includes three broad fields of work: exploration, drilling and oilfield servicing, and well operation and maintenance. Firms that specialize in one or more of these activities under contract to oil companies employ almost one-half of all workers in petroleum production. Major oil companies also engage in all of these production activities.

Since oil is difficult to find—rarely do any signs appear on the earth's surface—an important part of petroleum production involves scientific methods. After studies indicate the possible presence of oil beneath the earth's surface, a site is selected and drilling begins.

Before a well can be drilled, a towerlike steel rig is installed to support the tools and pipes used to drill and line. Today most rigs are portable but some are built at the site.

Although a few large firms do some of their own drilling, over 95 percent of this work is done by contractors. Other services connected with drilling include building roads, hauling supplies, cementing wells, cleaning, treating and testing wells. Contractors handle much of this work.

When oil is reached and the well is completed, the drilling crew is finished and the well-operating crew begins. About half of all petroleum production workers operate or maintain the approximately 665,000 producing oil and gas wells in the United States. These wells are operated by thousands of companies ranging in size from large firms with wells all over the world to small firms with only a single well. Oil or gas is brought out of the ground and is transported to refineries or processing plants by pipelines or in the case of oil also by ship, barges and trucks.

Processing plants are usually located at or near gas fields to remove dissolved liquid compounds and to let natural gas flow more easily through pipelines for long distances. The liquid compounds—chiefly ethane, propane, butane, and natural gasoline—have important uses as raw materials for the chemical industry and oil refineries and as a fuel for rural areas. In addition, natural gas may be compressed for delivery to pipeline transportation companies, or for use by oil well operators to force oil out of the ground.

In 1970 about 266,800 wage and salary workers were employed in the United States in petroleum production, including the production and processing of natural gas. Although drilling for oil and gas is done in about three-fourths of the States, nearly 90 percent of the workers are employed in 10 States. Texas is the leading State in the number of oilfield jobs, followed by Louisiana, California, Oklahoma, Kansas, New Mexico, Wyoming, Colorado, Illinois and Mississippi. About 15,000 additional American workers employed by oil companies work in foreign countries, particularly the Middle East, Africa, Western Europe, South America, and Indonesia.

Occupations in the Industry

Workers in petroleum exploration and production are required to have a wide range of education and skills to drill, operate, and maintain wells.

Exploration. Exploring for oil is the first step in petroleum production. Small crews of specialized workers travel to remote areas to search for geological formations likely to contain oil. Exploration parties, led by a *petroleum geologist* (D.O.T. 024.081), study the surface and subsurface composition of the earth. Geologists seek clues to the possibility of oil traps by examining types of rock formations on and under the earth's surface. Besides making detailed, foot-by-foot ground surveys, petroleum geologists depend on aerial exploration and magnetic surveys for a broad picture of the surface and subsurface features of the area. They also may obtain rock samples from the bottom of the sea in their search for clues to oil-bearing formations. Geologists can determine the age of rocks by measuring their radioactivity and by studying their fossil remains. Sub-surface evidence is collected by making test boring and bringing up core samples of the rocks, clay, and sands that form the layers of the earth. From these examinations, geologists draw cross-section maps of the underground formations being surveyed to pinpoint areas where oil or gas may be located.

Geologist and petroleum engineer inspect core sample.

Many geologists work in district offices of oil companies or exploration firms where they prepare and study geological maps. They also study core samples from test drilling to find any clue to the presence of oil.

In addition to the petroleum geologist, exploration parties may include other geologists specialists: *Paleontologists* (D.O.T. 024.081) who study fossil remains in the earth to locate oil-bearing sands; *mineralogists* who study physical and chemical properties of mineral and rock samples; (D.O.T. 024.081) stratigraphers (D.O.T. 024.081) who determine the rock layers most likely to contain oil and natural gas; *photogeologists* (D.O.T. 024.081) who examine and interpret aerial photographs of land surfaces; and *petrologists* (D.O.T. 024.081) who investigate the history of the formation of the earth's crust. Exploration parties may also include draftsmen (D.O.T. 010.281), and surveyors (D.O.T. 018.188) who assist in surveying and mapping operations.

More than 95 percent of geophysical exploration is done by seismic prospecting. The seismograph is a sensitive instrument which records natural and manmade earthquakes. Manmade earthquakes in petroleum exploration are commonly made by detonating charges of explosives in the ground. The time it takes for sound waves to reach an underground rock layer and return indicates the depth of the layer. The seismograph records give information by wavy lines on a chart. Increasingly, this information is recorded on magnetic tape which is then placed in a computer and analyzed automatically. By setting off explosions at a number of points on the surface underground formations can be mapped with considerable accuracy, thus providing a clue to the whereabouts of traps which may contain oil.

A *geophysicist* (D.O.T. 024.081) usually leads a seismograph crew which may include *prospecting computers* (D.O.T. 010.288) who perform the calculations and prepare maps from the information recorded by the seismograph; *observers* (D.O.T. 010.168), who operate and maintain electronic seismic equipment; *shothole drillers* (D.O.T. 930.782) and their *helpers* (D.O.T. 930.886), who operate portable drilling rigs to make holes into which explosive charges are placed; and *shooters* (D.O.T. 931.381), who place and detonate explosive charges.

Before geophysical exploration the oil company must obtain permission to use the land. The *landman* or *leaseman* (D.O.T. 191.118) makes the necessary business arrangements with land owners or with owners of mineral interests.

Drilling. Despite all the exploration methods developed, no device actually will locate petroleum. Only by drilling can the presence of oil be proved. Overall planning and supervision of drilling are usually the responsibilities of the *petroleum engineer* who helps to prepare drilling sites.

No matter which method of drilling is used—rotary or cable-tool, all wells are started in the same way. *Rig builders* (D.O.T. 869.884) and a crew of *helpers* (D.O.T 869.887) install a drilling rig to support the machinery and equipment which raise and lower the drilling tools.

The rotary method drills deep wells through rock as well as sand and clay formations.

In rotary drilling, a revolving steel drill bit, with cutting teeth at its lower end, bores a hole in the ground by chipping and cutting rock. The bit is attached to a length of joined pipe (drill stem), which is rotated by a rotary table, driven by a steam, diesel, or gasoline engine or an electric motor. As the bit cuts through the earth, the drill stem is lengthened by the addition of more pipe which is screwed on at the upper end. A stream of mud is continuously pumped through the hollow pipe and through jet ports in the drill bit. This mixture of clay chemicals, and water cools the drill bit, plasters the walls of the hole to prevent cave-ins, and carries the

Driller guides drill bit.

cuttings to the surface. Its weight helps to prevent blowouts from pockets of high-pressure gas.

A typical rotary drilling crew consists of a driller and four or five helpers. Divided into three crews, 15 to 20 workers generally operate a rig 24 hours a day 7 days a week. A *rotary driller* (D.O.T. 930.782) operates the machinery which controls speed and pressure, selects the proper drill bit, and records operations. He must meet any emergency, such as a breakdown of equipment or unusual geological formations.

A *derrickman* (D.O.T. 930.782), second in charge will work on a small platform high on a rig whenever running in or pulling pipe from a drilled hole. From that position he can better assist in removing the drill pipe from a well opening to bring a worn bit to the surface for replacement. Whenever in the hole and drilling, he starts and operates pumps to circulate mud through drill pipe and borehole to cool the drill bit.

Other members of a typical rotary drilling crew include *rotary helper* (D.O.T. 930.884), (also known by several other titles such as roughneck or piperacker) who guide the lower end of the pipe to and from the well opening and connect and disconnect pipe joints and drill bits. An *engineman* (D.O.T. 950.782) (if diesel or electric power is used) may be added to operate the engines which provide power for drilling and hoisting.

The *tool pusher* or *chiefdriller* (D.O.T. 931.130) acts as foreman of one or more drilling rigs and supplies materials and equipment to rig builders and crews. *Roustabouts* (D.O.T. 869.884) or general laborers, though not considered part of the drilling crews, are general oil field maintenance and construction men who string pipe, clean tanks, construct foundations and roads, and work as helpers with welders and other craftsmen.

In cable-tool drilling, a hole is broken through rocks by continuously raising and dropping a heavy, sharpened bit attached to the end of a cable. Cable-tool drilling is used mainly to drill shallow wells in soft rock formations mostly in Kentucky, Ohio, West Virginia, Pennsylvania, and certain areas of Texas and Oklahoma. Cable-tool drilling, however, is becoming obsolete as deeper holes are required each year to reach new oil reserves.

The *cable-tool driller* (D.O.T. 930.280), who works with a tool dresser, maintains a detailed record of drilling. He controls the force with which the drilling bit strikes the rocks at the bottom of the well. He also supervises and helps to set the machinery and derricks.

Well Operation and Mainte-

nance. Production begins when oil is found and the equipment is installed. Drill pipe and a bit are pulled from the well and casing is lowered and cemented in place. The upper ends of the tubing and casing are fastened to a system of valves called a "Christmas tree." Pressure in the well forces crude oil and gas to the surface, through the Christmas tree, and into gas traps and storage tanks. If natural pressure is not great enough to force the oil to the surface, pumping or other methods are used to produce an artificial flow.

Petroleum engineers generally plan and supervise the operation and maintenance of wells. To prevent waste, they decide the rate of oil flow and anticipate performance of oil reservoirs by daily analyzing pressure readings and other data of oil wells. For this purpose engineers are increasingly using simulation methods with computers which enables them to analyze the most complex oil and gas underground reservoirs. They may specialize in overcoming effects of corrosion on well casings, in the selection and design of production equipment and processes, or in the prevention of pollution.

Some companies hire engineer aides for running tests, keeping records, posting maps, and making standard calculations.

Pumpers (D.O.T. 914.782) and their helpers (D.O.T. 914.887, usually referred to as roustabouts) operate and maintain motors, pumps, and other equipment to force an artificial flow of oil from wells. Their chief duty is to regulate the flow of oil according to a schedule set up by the petroleum engineer and production foreman. Generally, a pumper operates a group of wells. *Switchers* work in fields where oil flows under natural pressure and does not require pumping. They open and close valves to regulate the flow of oil from wells to tanks or into pipelines. *Cagers* (D.O.T. 914.381) measure and record the flow of oil into tanks or pipelines and take samples to check quality. *Treaters* (D.O.T. 541.782.) test crude oil for water and sediment and remove these impurities by opening a drain at the base of the tank or by using special chemical or electrical equipment. In some fields, pumping, switching, gaging, and treating operations are automatic. Some fields have computer systems at a central site enabling an operator to control the oil flow from a large number of wells into several pipelines.

Many skilled workers are employed in maintenance operations. Welders, carpenters, electricians, and machinists repair and install pumps, gages, pipes, and other equipment.

Natural Gas Processing. Operators have duties very similar to those of the oil refinery workers. The *dehydration-plant operator* (D.O.T. 541.782) tends an automatically controlled treating unit which removes water and other impurities from natural gas. The *gasoline-plant operator,* or *gasoline-plant engineer* (D.O.T. 950.782), operates equipment which removes natural gasoline and sulfur from natural gas. The *compressor-station operator, or compressor-station engineer* (D.O.T. 914.132), operates a compressor which raises the pressure of the gas for transmission in the pipelines. The *gas-compressor operator* (D.O.T. 950.782), assists either of the last two employees named above.

As in oil refineries, many workers in the larger natural gas processing plants are employed in maintenance activities. However, the equipment in such plants is subject to less corrosion and wear than that in oil refineries and it is generally more automated. As a result, the instrument repairman and the electrician are two key workers needed to maintain the instruments that control the automatic equipment. The welder and his helper also do much maintenance work in the processing plant. Other maintenance workers include engine repairmen, roustabouts, helpers or laborers.

A smaller proportion of clerks, administrators, professional, and technical workers are employed in the larger gas processing plants than in oil refineries.

In numerous smaller natural gas plants, workers combine skills, usually of operator and maintenance man. In addition, many small plants are so highly automated they are virtually unattended. They are checked by maintenance workers or operators at periodic intervals, or they are monitored continuously by instruments which automatically report malfunctions and shut down the plant if an emergency develops.

Other Oilfield Services. Companies which offer services on a contract basis provide another important source of employment. Among these employees are skilled workers such as *cementers* (D.O.T. 930.281), who mix and pump cement into the space between steel casings and side walls of the well to prevent cave-ins; *acidizers* (D.O.T. 930.782), who force acid into the bottom of the well to increase the flow of oil; *perforator operators* (D.O.T. 931.782), who pierce holes in drill pipes or casings by using subsurface "guns" to make passages through which oil can flow; *sample-taker operators* (D.O.T. 931.781), who obtain samples of soil and rock formations from wells to help geologists determine the presence of oil; and *well puller*

(D.O.T. 930.883), who remove pipes pumps and other subsurface devices from wells for cleaning and repairing or for salvaging.

Offshore Operations. Most exploration, drilling, and producing activities are done on land, but an increasing amount of this work is done offshore, particularly in the Gulf of Mexico off the coasts of Louisiana and Texas. Some additional offshore work is being done in the Pacific Ocean off California, Oregon, Washington, Alaska and in many foreign locations Nigeria, Persian Gulf, Indonesia, Bass Strait, and North Sea. Some wells have been drilled more than 100 miles from shore and in water more than 1,000 feet deep. These offshore operations require the same types of drilling crews as are employed on land operations. In addition, offshore operations require employment of radio men, ablebodied seamen, cooks, mess boys, and pilots for work on drilling platforms, crewboats, barges, and helicopters.

(Detailed discussions of professional, technical, mechanical, and other occupations found not only in the petroleum and natural gas production industry, but in other industries as well, are given elsewhere in the *Handbook,* in the sections covering the individual occupations. See index for page numbers.)

Training, Other Qualifications, and Advancement

Exploration. Most workers in nonprofessional jobs with an exploration crew begin as helpers and advance into one of the specialized jobs. Their training may vary from several months to several years. New workers usually are hired in the field by the party chief or by local company representatives. For many nonprofessional jobs, companies hire young men who have a high school or vocational school education, including training or aptitude in mathematics, drafting, and mechanics. College students majoring in physical or earth sciences or in engineering often work part-time or summer with an exploration crew. This may be a means of working into a full-time job after graduation.

For entry into professional occupations, such as geologist, geophysicist, chemist, or engineer, college training with at least a bachelor's degree is required. Professional workers usually start at junior levels and after several years of experience in field surveys, are eligible for promotion to the job of party chief. After much field survey experience they may get a position of responsibility in an area or division office and then perhaps in the central office. Scientists and engineers having research ability, preferably those with advanced graduate degrees, may transfer to research or consulting work.

Drilling. Members of drilling crews usually begin work in the industry as roughnecks. As they acquire experience, they may advance to more skilled jobs. In rotary drilling, for example, a worker may be hired as a roughneck, advance to the job of derrickman. And after several years, he may become a driller. He then may be promoted to the job of tool-pusher, in charge of one or more drilling crews. Some drilling companies hire high school and college students for jobs during the summer months.

Drilling requires men capable of doing heavy physical labor. Drilling crew members usually are between the ages of 20 and 40. Some companies, however, report that their best drillers are over 50 and even in their sixties, for the job of driller requires good judgment combined with practical experience. The drillers job is less demanding physically than roughneck or derrickman.

Well Operation and Maintenance. Companies generally hire persons who live near operating wells for well operation and maintenance jobs. They prefer men who have mechanical ability and a knowledge of oilfield processes. Because this type of work is less strenuous and offers the advantage of a fixed locale, members of drilling crews or exploration parties who prefer not to travel often transfer to well operation and maintenance jobs.

New workers may start as roustabouts and advance to jobs as switchers, gagers, or pumpers. Training usually is acquired on the job; at least 2 years of experience are needed to become a good all-round pumper.

The preferred educational qualification for a petroleum engineer is a college degree with specialization in courses on the petroleum industry. However, college graduates having degrees in chemical, mining, or mechanical engineering, or in geology, geophysics, or other related sciences, sometimes are hired for petroleum engineering jobs. Petroleum engineering aids frequently are people with 2-year technical degrees but also include former roustabouts or pumpers who are given several months of specialized on-the-job and classroom training.

Information on occupational training, qualifications, and advancement in natural gas processing plants is similar to that for occupations in petroleum refining, discussed on page 709.

Employment Outlook

Many thousants of new workers will be hired each year during the 1970's for exploration, drilling, and oil and gas production, to replace workers who retire, die, or transfer to other fields of work.

Employment in petroleum and natural gas production during the 1970's is expected to show little change. More intensive exploration and drilling anticipated during the 1970's, particularly in Alaska and offshore, is expected to keep the number of workers at present levels despite the use of data-processing equipment and improved seismic techniques.

In addition to untrained field workers, the petroleum industry will need workers who have electrical and mechanical training or experience to maintain and repair the increasingly complex equipment.

Earnings and Working Conditions

In 1970 earnings of nonsupervisory employees in oil and gas extraction averaged $153.87 a week, or $3.57 an hour. This compares with average earnings of $133.73 weekly or $3.36 an hour for all production workers in manufacturing establishments.

Most oilfield employees work outdoors in all kinds of weather. Although some fields may be near cities, they are more often far from sizeable communities, sometimes in swamps or deserts. Increasingly oilfield employees are involved in offshore operations. Drilling employees may expect to move from place to place since their work in a particular field may be completed in less than a year. Exploration field personnel move even more frequently. They may be away from home for weeks or months at a time and live in a trailer or tent. Well operation and maintenance workers often remain in the same location for long periods. Drilling is one of the most hazardous occupations in all industry.

Most workers in natural gas processing plants and oil refineries have similar working conditions. Only a moderate amount of physical effort is involved. Some workers open and close valves, climb stairs and ladders to considerable heights, and work 1 of 3 shifts in relatively safe plants.

Employees in some natural gas processing plants have unusual working conditions. They travel rough, unpaved terrain periodically in all kinds of weather to check several small, unattended automated plants in widely separated, isolated locations. These maintenance jobs may be very satisfying to those who like working outdoors alone.

In offshore operations, earnings usually are higher than those in land operations. Except for drilling activity that is close to shore, workers living quarters are on platforms held fast to the ocean bottom or on ships anchored nearby. In offshore operations many work 7 days on at 12 hours a day followed by 7 days off.

Sources of Additional Information

Further information, concerning jobs, processes, and working conditions in the petroleum industry can be obtained from the public relations department of individual petroleum companies and from:

American Petroleum Institute,
1801 K St., N.W.
Washington, D.C. 20006

National Petroleum Refiners Association
1725 DeSales St. N.W.,
Washington, D.C. 20036

American Association of Petroleum Geologists
P.O. Box 979
Tulsa, Oklahoma 74101

American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME)
345 East 47th Street
New York, N.Y. 10017

CONSTRUCTION

The activities of the construction industry touch nearly every aspect of our daily lives. The houses and apartments we live in; the factories, offices, and schools in which we work; and the roads we travel upon are examples of some of the products of this important industry. The industry encompasses not only new construction projects but also includes additions, alterations, and repairs to existing structures.

In 1970, about 3.3 million persons were employed in the contract construction industry. An additional 1.4 million workers are estimated to be either self-employed—mostly owners of small building firms—or are State and local government employees engaged in building and maintaining our Nation's vast highway system.

The contract construction industry is divided into three major segments. About half of the work force is employed by electrical, air conditioning, plumbing, and other special trade contractors. Almost one-third work in the general building sector where most residential, commercial, and industrial construction occurs. The remaining one-fifth, are engaged in building dams, bridges, roads, and similar heavy construction projects.

As illustrated in the accompanying tabulation, workers in all blue-collar occupations made up nearly four-fifths of the construction industry employment in 1970. Craftsmen and foremen alone account for more than one-half of the total employment in this industry—a much higher proportion than that of any other major industry. Most of these skilled workers are employed as carpenters, painters, plumbers and pipefitters, construction machinery operators, and bricklayers, or in one of the other construction trades. Laborers are the next largest occupational group and account for 1 out of 6 workers. They provide material, scaffolding, and general assistance to the craftsmen at the worksite. Semiskilled workers (operatives and kindred workers), such as truck drivers, welders and apprentices, represent about one-tenth of the industry's total work force. Managers, officials, and proprietors —mostly self-employed—also account for about the same share of employment. Professional and technical workers make up 5 percent of the work force employed in construction. Engineers, together with engineering technicians, draftsmen, and surveyors account for most of the employment in this occupational group. Clerical workers, largely women working as stenographers, typists, and secretaries, and in general office work, constitute another 5 percent of the industry's employment.

Major occupational group	*Estimated employment, 1970 (percent distribution)*
All occupational groups	100
Professional, technical, and kindred workers	5
Managers, officials, and proprietors	12
Clerical and kindred workers	5
Sales workers	(1)
Craftsmen, foremen, and kindred workers	51
Operatives and kindred workers	10
Service workers	(1)
Laborers	17

[1] Less than 0.5 percent.

Through the 1970's, employment requirements are expected to rise rapidly in the construction industry. As the national economy expands, as population increases, and as personal and corporate incomes rise, the demand for contract construction activities are expected to undergo a substantial increase. Likewise, the number of construction workers employed by State and local highway departments also is expected to increase because of the need to meet the demands of the country's expanding highway systems. Even though employment in the construction industry is likely to grow, the increasing application of the latest technology in tools, material, and work methods, together with the rising skill level of he work force, will make it possible to increase the level of construction activity without a correspondingly large increase in employment.

Contract construction is the major source of employment for skilled craftsmen such as bricklayers, painters, carpenters, and others who are discussed more fully elsewhere in the *Handbook*. For information on these and similar construction occupations, see the Building Trades chapter of the *Handbook*. For information on occupations which are found in many other industries, see the index in back of the book.

MANUFACTURING

Manufacturing is the activity around which our Nation's economy revolves. From factories flow the goods that have provided a standard of living unmatched elsewhere in the world. The products of the manufacturing industries range in complexity from a simple plastic toy to an intricate electronic computer, and in size from miniature electronic components to gigantic nuclear powered aircraft carriers. Many diverse processes are carried out in manufacturing. Workers refine ores and petroleum, process foods and chemicals, print books and newspapers, spin and weave textiles, fabricate clothing and footwear, and produce the thousands of products needed for our personal and national benefit. Our society, as we know it today, could not have reached its present level of prosperity without the goods provided by the manufacturing industries.

About 19.4 million persons worked in manufacturing—the largest of the major industries—in 1970. Within manufacturing, durable goods industries accounted for nearly three-fifths of all workers. The largest employers in the durable goods industries were the machinery, electrical equipment, and transportation equipment industries, and the fabricated metal and primary metals industries. Each of these industries accounted for at least 1 million workers and ranged from 1.3 million in primary metals to nearly 2 million in machinery. Producers of nondurable goods account for another two-fifths of total employment in manufacturing. The food processing industries had the largest single work force within this group—1.8 million workers—more than one-fifth of all nondurable goods employment. Other large employers in the nondurable goods industries are the apparel, printing, chemicals, and textile industries. Employing fewer than 80,000 workers, tobacco manufacturers are the smallest industry in manufacturing.

In 1970, nearly 5.5 million women were employed in manufacturing, and accounted for more than 1 out of every 5 women who worked. Large numbers are employed as secretaries, typists, office machine operators, and in many other office clerical occupations. Women represent a large proportion of the production workers in some industries, particularly the apparel, textiles, tobacco, and leather products industries. Thousands of women hold jobs as assemblers, sewers, checkers and sorters, inspectors, and other types of production workers. In heavy industries such as primary metals, transportation equipment, petroleum refining, and lumber and wood products, women are employed almost exclusively in white-collar occupations and consequently make up only a small part of the total work force.

As illustrated in the following table, blue-collar jobs made up 67 percent of the employment in manufacturing in 1970. Operatives and kindred workers alone accounted for 43 percent of the work force. Many of these semiskilled workers were spinners and weavers (textile industry), sewing machine operators (apparel and leather industries), machine tool operators and welders (metalworking industries), furnacemen and heaters (primary metals), or operators of the specialized processing equipment used in the food, chemical, paper, and petroleum industries.

Craftsmen, foremen, and kindred workers make up the next largest group of workers and account for nearly one-fifth of the employment in manufacturing in 1970. Many of these skilled workers install and maintain the wide assortment of machinery and equipment required in all manufacturing industries. Others are employed in skilled production occupations and are engaged directly in the manufacturing process. Machinists, for example, are especially important in the metalworking industries, as are skilled inspectors and assemblers. In the printing and publishing industries, compositors and typesetters, photoengravers and lithographers, and pressmen make up a large share of the work force. Bakers, millers, stillmen, tinsmiths, millwrights, and tool and diemakers are a few of the other important skilled occupations in manufacturing.

Clerical workers represent the third highest concentration of workers—approximately 1 out of every 8—and in manufacturing were the largest white-collar occupational group.

Professional, technical, and kindred workers accounted for 1 out of every 10 workers employed in manufacturing. Engineers, scientists, and technicians represent a large share of the professional workers employed in manufacturing. These highly trained workers are required not only to oversee and guide the production processes, but also to carry out the extensive research and development activities needed in the aerospace, electronics, chemical, petroleum, and other industries. Other important professional occupations in manufacturing are editor and reporter, accountant, and personnel and labor relations worker.

Major occupation group	*Estimated employment, 1970 (percent distribution)*
All occupational groups	100
Professional, technical, and kindred workers	10
Managers, officials, and proprietors	7
Clerical and kindred workers	12
Salesworkers	3
Craftsmen, foremen, and kindred workers	19
Operatives and kindred workers	43
Service workers	1
Laborers	5

NOTE: Because of rounding, sums of individual items may not add to total.

Population growth, rising personal income, and expanding business activity will stimulate a substantial increase in the demand for manufactured products through the 1970's. Employment in manufacturing, however, is expected to increase at a slower pace or about 13 percent between 1970 and 1980. The increasing application of modern technology to manufacturing processes, together with the rising skill level of the work force, will make possible substantial increases in production of goods without a corresponding increase in the work force. Although the average rate of employment growth will be slow, employment trends of individual industries within manufacturing will vary widely. In the rubber and miscellaneous plastics products and furniture and fixtures industries, employment is expected to increase about one-third, far above the average increase. Employment in several other industries—including machinery, apparel, instruments, and stone, clay, and glass—is expected to increase more rapidly than the average for all manufacturing. On the other hand, some manufacturing industries expect employment to decline. Petroleum refining, tobacco, food, and textiles all may decrease in employment during the 1970's.

The statements that follow provide information on employment opportunities in several of the manufacturing industries. More detailed information about occupations that are found in many industries appears elsewhere in the *Handbook*. (See index in the back of the book.)

OCCUPATIONS IN AIRCRAFT, MISSILE, AND SPACECRAFT MANUFACTURING

Known generally as the "aerospace" industry, the manufacture of aircraft, missiles, and spacecraft is among the largest and most rapidly changing industries in the country. Some 1.25 million persons were employed in the industry in 1970, many of them work with developments in supersonic flight and space exploration. These and other activities in research and development have made the industry different from most manufacturing. Intensive effort has been required to develop the materials, products, and concepts for activities such as space travel.

Because this industry's products are complex and changing, scientists, engineers, and technicians represent a large proportion of total employment, and probably will account for an even larger proportion through the 1970's.

Electronic technician conducts system tests.

Nature and Location of the Industry

Aircraft, missiles, and spacecraft have the same main components: A frame to hold and support the rest of the vehicle, an engine to propel the vehicle, and a guidance and control system. Missiles and spacecraft reach into space and attain speeds many times that of sound, whereas aircraft fly in the earth's atmosphere at slower speeds. Aircraft are manned and missiles and some spacecraft are not.

Types of aircraft vary from small personal planes, costing not much more than an automobile, to multimillion-dollar giant transports and supersonic fighters. Aircraft plants also produce smaller planes for business and personal use, and helicopters. One-half to two-thirds of aircraft production in dollar value is manufactured for military use; however the proportion for nonmilitary purposes—for commercial passenger and freight traffic, private business and pleasure use and civilian flying instruction has been increasing.

Missiles and spacecraft also vary greatly in the purposes for which they are made, and in their size, and capabilities. Missiles are produced chiefly for military use and generally carry destructive warheads. Some can travel only a few miles and are intended for purposes such as the support of ground troops and defense against low flying aircraft. Others, such as the Atlas, Titan, and Minuteman, have intercontinental ranges of 7,000 miles or more. Some missiles are designed for launching from land or underground sites; others, for firing from aircraft, submarines, or ships.

Spacecraft are sent aloft carrying instruments which can measure and record conditions in space and transmit the data to receiving stations on earth. Manned spacecraft also include a cabin capsule for astronauts. The first American space vehicles had payloads (useful cargo) weighing only 20 to 30 pounds or less; the Saturn V launch vehicle is able to lift almost 150-ton payloads into near-earth orbit, or send 50 tons to the moon. Some space vehicles probe the space environment and then fall back to earth. Others are put into orbit and become artificial satellites around the earth, sun, or other celestial bodies or land on the moon. Nearly all of this country's missles and spacecraft are built for the Air Force, Navy, Army, or the National Aeronautics and Space Administration (NASA).

Because the aerospace industry makes many kinds of finished products, it uses many kinds of engines, electronic systems, and other components. Aircraft engines are reciprocating (piston), jet, or rocket. Missile engines are jet or rocket. Spacecraft are rocket powered because rockets are the most powerful type of engine and can operate in airless space, whereas other engine types need oxygen from the air for combustion. Today's rocket engines are powered by chemical propellants, either liquid or solid. New sources of rocket propulsion, such as nuclear or electric energy, are being investigated and may be available in the future. Guidance, control, and instrument payload systems are largely electronic. Missles and spacecraft generally have more complex guidance and control systems than aircraft.

Inspector makes final check on attitude control engine for spacecraft module.

An aircraft, missile, or spacecraft is manufactured usually under the technical direction of a prime contractor. He manages and coordinates the entire project, subject to periodic inspections by the Federal agency or the airline ordering the vehicle. His engineering department prepares design drawings, blueprints, and other specifications. These go to the production department, where planners work on the many details regarding machines, materials, and operations needed to manufacture the vehicle in the numbers required. Decisions must be made as to what part of the production work will be done by the prime contractor, and what part will be subcontracted to outside firms.

Special tools, dies, jigs, and fixtures are required in manufacturing the vehicle. Many sheet-metal workers, machinists, machine tool operators, and other metal processors produce these tools and the thousands of parts and components which make up the craft. All parts and equipment must be inspected and tested many times, both before and after they are assembled, and all assembly work must be thoroughly inspected and checked. In every stage of the production process, assemblers and installers are needed to fit together, hook up, and install systems and components. After its final assembly, the vehicle is checked out by a team of mechanics, flight tested if an aircraft, and then prepared for delivery.

Many thousands of subcontractors participate in the production of parts and subassemblies that make up aircraft, missiles, and spacecraft. Some subcontractors make individual parts or supplies such as metal forgings, bearings, plastic material, rocket fuels, or special lubricants. Others produce subassemblies, such as communications or telemetry equipment, guidance instruments, or jet engines, and may depend on other subcontractors to supply parts for the subassemblies. The prime contractor, too, may manufacture components of a craft and may do the final assembly work.

Aerospace plants range in size from the large factories of major manufacturers, each with thousands of employers, to the shops of small subcontractors and suppliers that employ only a few workers each. Jobs in aerospace work may be found in practically every State, although roughly one-third are concentrated in California. Other States with large numbers of aerospace jobs include New York, Washington, Connecticut, Texas, Florida, Ohio, Missouri, Pennsylvania, Massachusetts, Kansas, Alabama, Maryland, New Jersey, and Georgia.

An estimated 1.25 million people —more than one-sixth of them women—worked in aerospace in 1970. Employment has dropped sharply from 1968 highs and reflects decreased aircraft requirements for Vietnam, reduced expenditures for space exploration, and lower commercial aircraft sales. About 400,000 of these workers were producing missiles and spacecraft; approximately 600,000 were making aircraft, aircraft engines, and propellers; and about 200,000 produced electronic equipment for aircraft, missiles, and spacecraft. The remainder, mostly civilian employees of the Federal Government, worked in the Department of Defense and NASA. In addition, thousands of other Federal workers were engaged in the negotiation, administration, and supervision of related contracts.

Workers with many different kinds of educational backgrounds and job skills are needed to design and manufacture aircraft, missles, and spacecraft; for example, engineers and scientists who have advanced degrees, as well as plant workers who can learn their jobs after a few days or weeks of training, are employed.

Depending on the work, occupational needs vary among establishments in the industry. Manufacturers, universities, independent research organizations, and Government agencies, such as the Air Force and NASA, operate research and development laboratories employing mainly engineers and scientists, and supporting technicians and craftsmen. On the other hand, production operations in factories have mostly plant workers, such as assemblers, inspectors, and machinists.

Some of the more important jobs in aerospace are described under three main categories: Professional and technical; administrative, clerical, and related occupations; and plant occupations. Many of these jobs are found in other industries as well and are discussed in greater detail elsewhere in the *Handbook* in sections covering individual occupations.

Physicist uses laser beam during research on laser development.

Professional and Technical Occupations. Before production of an aircraft, missile, or spacecraft can begin, a design must be approved. This requires many experiments and "feasibility" studies to determine how well various design possibilities meet the conditions under which the vehicle will be operating. A scale model is made from the approved design. It is tested in wind, temperature, and shock tunnels, on ballistic ranges, and in centrifuges where actual flight conditions are simulated. The next step is to develop a full-sized experimental model or prototype, which is thoroughly tested in the air and on the ground. If test results are satisfactory, production may begin. Many modifications in the craft normally are made during the course of design and development, and often even after production has started.

The pace of discovery and change is so rapid that much equipment becomes obsolete while still in the experimental stage or soon after being put into operation. Research and development are vital in the industry, particularly in missles and spacecraft. Efforts are being made to develop aerospace vehicles with greater speeds, ranges, and reliability; engines with more power; and metals and plastics with wider capabilities. The industry's research and development capability has encouraged aerospace firms to apply their abilities to other areas of exploration such as oceanographic research and hydrofoil ocean vessels.

Emphasis on research and development makes the aerospace industry an important source of jobs for engineers, scientists, and technicians. In 1970, almost one-fourth of all employees were engineers, scientists, and technicians, a considerably higher proportion than in most other manufacturing industries.

Many kinds of engineers and scientists are employed in aerospace work. For example, over 30 different college degree fields are represented among the engineers and scientists employed by NASA.

Electronic, electrical, aerospace, chemical, nuclear, mechanical, and industrial engineers are among the larger engineering classifications. Scientists in the industry include physicists, mathematicians, chemists, metallurgists, physiologists, and astronomers. Aerospace engineers and scientists work in a wide and varied range of applied fields such as materials and structures, energy and power systems, and space sciences.

Engineers and scientists are assisted by many types of workers, such as draftsmen, mathematics aids, and laboratory and electronics technicians. They also work with *production planners* (D.O.T. 012.188), who plan the layout of machinery, movement of materials, and sequence of operations so that manufacturing processes will flow efficiently from one step to the next; and they work with *technical writers* (D.O.T. 139.288) and *technical illustrators* (D.O.T. 017.281), who produce technical manuals and other literature used to describe the operation and maintenance of aircraft and spacecraft and their many parts.

Administrative, Clerical, and Related Occupations. Managerial and administrative jobs generally are comparable with similar jobs in other industries, except that they are related most closely to engineering because of the importance of research and development in the aerospace field. Personnel in these jobs include executives, responsible for the direction and supervision of research and production; and officials in departments such as sales, purchasing, accounting, and industrial relations. Many thousands of clerks, secretaries, stenographers, typists, tabulating machine operators, and other office personnel also are employed.

Plant Occupations. About half of all workers in the aircraft, missile, and spacecraft field were employed in plant jobs in 1970. Plant jobs can be classified in the following groups: Sheet-metal work; machining and tool fabrication; other metal processing; assembly and installation; inspecting and testing; flight checkout; and materials handling, maintenance, and custodial.

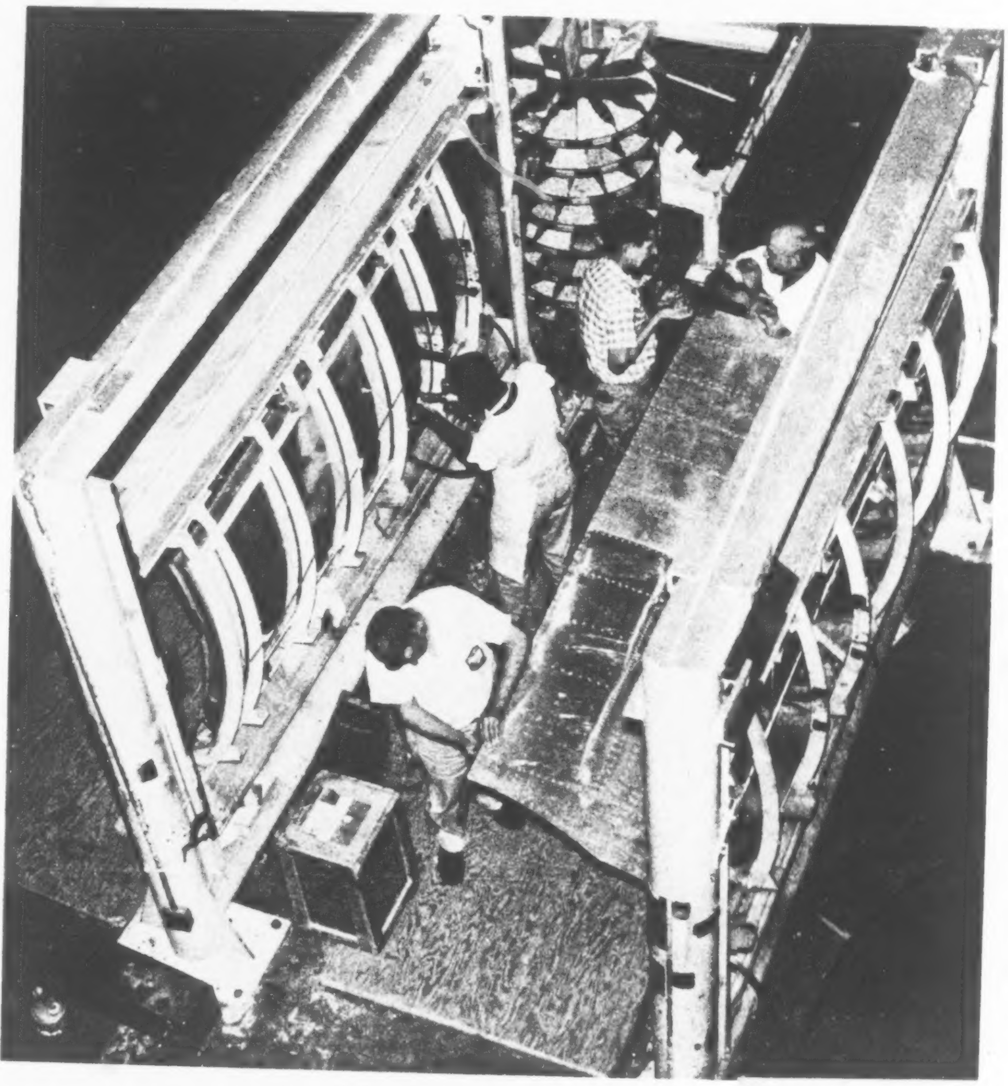
Sheet-Metal Occupations. Sheet-metal workers shape parts from sheet metal by hand or machine methods. When hand methods are used, the workers shape the part by pounding them with mallets and by bending, cutting, and punching them with handtools. Machine methods involve the use of power hammers and presses, saws, tube benders, and drill presses. The all-round *sheet-metal worker* (D.O.T. 804.281) lays out the sequence of operations on the basis of blueprints and other engineering information. He then fabricates complicated metal shapes, using handtools or machines. Less complex parts, as well as those produced in large numbers, are fabricated by less skilled sheet-metal workers or workers who specialize in operating a single machine. They have titles such as *power brake operator* (D.O.T. 617.380), *power hammer operator* (D.O.T. 617.782), *power shear operator* (D.O.T. 615.782 and 615.885), *punch press operator* (D.O.T. 615.782), and *profile cutting machine operator* (D.O.T. 816.782).

Machining and tool fabrication occupations. Another important group of workers engaged in shaping and finishing metal parts with machine tools are *machinists* (D.O.T. 600.280 and .281) and *machine tool operators* (D.O.T. 609.885). The most skilled of these are the all-round or general machinists who can lay out the work and set up and operate several types of machine tools. They perform machining operations of a highly varied and nonrepetitive nature. They are employed most frequently in departments engaged in experimental and prototype production.

Machine tool operators produce metal parts in large volume. They generally operate a single type of machine tool such as a lathe, drill press, or milling machine. More skilled operators set up work on a machine and handle difficult and varied jobs. Less skilled operators do repetitive work.

Machinists and machine tool operators represent a higher proportion of the work force in engine and propeller plants, which are basically metalworking establishments, then in plants performing the final assembly of air and space vehicles. Among engine plants, those manufacturing reciprocating engines do relatively more machining and less sheetmetal work than those producing jet or rocket engines.

Many plants in aerospace make a large proportion of the jigs, fixtures, tools, and dies they use. Fabrication of these items requires skilled metal-processing workers, chiefly *jig and fixture builders* (D.O.T. 761.381) and *tool and die makers* (D.O.T. 601.280). Jig and fixture builders make the workholding and tool-guiding devices used in production and assembly operations. On the basis of information received from the engineering department, they plan the sequence of metal machining operations involved in making a jig and carry the job through to completion. Tool and die makers make the cutting tools and fixtures used in machine tool opera-



Assemblers rivet wing sections in floor jigs.

tions, and the dies used in forging and punch press work. They must be experts in the use of machine tools.

Other metal-processing occupations. Other metalworkers, such as tube benders, riveters, and welders also are employed. *Tube benders* (D.O.T. 709.884) form tubings used for oil, fuel, hydraulic, and electrical conduit lines. *Riveters* (D.O.T. 800.884) and *welders* (D.O.T. 810.782 and .884; 811.782 and .884; 812.884 and 813.380 and .885) join fabricated parts by hand or machine riveting and by electric arc, gas, or electric resistance welding.

Additional metal fabricating is performed by skilled foundry workers such as patternmakers, molders, and coremakers. Drop hammer operators and other forge shop workers are employed in the forging departments.

Many aircraft, missile, and spacecraft parts are chemically and heat-treated during several stages of their manufacture to clean, change, or protect their surface or structural condition. Sheet-metal parts are heat-treated to keep the metal soft and malleable while it is being worked into the required shape. Many processes, such as painting and plating, are used on the surfaces of parts. Workers in these metal-processing jobs have titles such as *heat treater* (D.O.T. 504.782), *painter* (D.O.T. 845.781), and *plater* (D.O.T. 500.380).

Assembly and installation occupations. Assembly and installation workers are a major occupational group, employed in practically all plants in the industry. Some work in the production of engines, electronic equipment, and auxiliary components, but most are employed in assembling complete air or space craft. They perform final assembly work such as the fitting together of major subassemblies and the installing of major components. In aircraft, for example, this work involves joining wings and tail to the fuselage and installing the engine and auxiliary equipment such as the fuel system and flight controls. Assemblers perform operations such as riveting, drilling, bolting, and soldering.

A large proportion of assemblers are semiskilled and do repetitive work, but some are skilled mechanics and installers. Many of the latter perform diversified assembly or installation operations, and often work on experimental, prototype, or special craft. They assemble, take apart, inspect, and install complex mechanical and electronic assemblies. They read blueprints and interpret other engineering specifications. They may be called *final assemblers* of complete aircraft (D.O.T. 806.781), *missile assembly mechanics or rocket assembly mechanics* (D.O.T. 625.281).

Some skilled assemblers are employed in plants which produce relatively large numbers of aircraft and missiles rather than a few experimental types. These assemblers usually specialize in one field of work or more. They often are assisted by less skilled assemblers who do the more routine work. For example, a *class A armament assembler* (D.O.T. 801.381) typically does work such as assembling, installing, and alining power turrets, weapons, gun cameras, and related acces-

Assembler works on section of fuselage frame.

sories. Lower rated armament assemblers typically do work such as uncrating and cleaning weapons, loading ammunition, installing armor plate, and placing parts in jigs. *Power plant installers* (D.O.T. 621.381), sometimes known as engine mechanics, install, aline, and check the various types of engines and accessories. Skilled *electrical assemblers* (D.O.T. 728.884), sometimes called electricians, install, hook up, and check major units in electrical or radio systems. They are assisted by less skilled assemblers, who do the more routine installations and wire routings by following standard wiring diagrams and charts. Assemblers also specialize in other systems such as plumbing, hydraulic, heating and ventilating, and rigging and controls.

Inspecting and testing occupations. Because aircraft, missles, and spacecraft are extremely complex, thousands of painstaking inspections and tests must be made as each component and part moves toward final assembly of the whole system. Inspections are made not only by employees of the manufacturers but also by civilian employees of Federal agencies which have contracted for the equipment.

Some inspectors specialize in examining materials and equipment purchased from the outside; others inspect components during fabrication and subassembly within their own plants; still others inspect completed craft after their final assembly. Many inspection jobs require highly skilled workers. On the other hand, some tests are made by automatic equipment which can be run by relatively unskilled persons. Such equipment not only checks the component or assembly under test but may run simultaneous checks on itself.

Among the most skilled inspectors, especially in final assembly plants, are *outside production inspectors* (D.O.T. 806.381). They examine machined parts, subassemblies, and tools and dies which have been ordered from other firms. They also serve as liaison men between their own engineering departments and supplying companies. Other inspectors, frequently known as *receiving inspectors* (D.O.T. 806.384), with less responsibility than outside production inspectors, check purchased materials and parts for conformity with blueprints, armed services requirements, and other established standards. They operate testing equipment and must be familiar with specifications of the parts and materials purchased from different sellers.

In the production department, *machined parts inspectors* (D.O.T. 609.381) determine, by the use of precision testing instruments, whether or not a part has been machined properly to conform to blueprint specifications. They also may test for hardness and porosity and determine the "machineability" of castings and forgings. *Fabrication inspectors* (D.O.T. 807.381) are generally skilled sheet-metal workers. They inspect fabricated sheet-metal work and complex parts which have required numerous fabricating operations.

As the parts are fitted together, they undergo numerous inspections by *assembly inspectors* (D.O.T. 806.381). These inspectors are employed, for the most part, in the later stages of the assembly process. They usually inspect complete major assemblies and installations, such as fuselage, wing, and nose sections, to insure their proper final fitting. They also check the functioning of systems such as hydraulics, plumbing, and controls. Less skilled assembly inspectors usually check subassemblies.

Flight checkout occupations. Checking out an aircraft or spacecraft before its first flight requires a team of mechanics having different levels and types of skills. Sometimes the checking-out process involves making repairs or returning the craft to the plant for repairs. The *chief mechanic or crew chief,* who is the most skilled worker of the team, is responsible for the entire checking-out operation, including repair work. He usually directs the work of a crew of mechanics, each of whom specializes in one field or more. For example, *engine mechanics* specialize in checking out the powerplant, including the engine, propellers, and oil and fuel systems. They use handtools, testing equipment, and precision measuring instruments. The *electronics checkout men* perform or supervise the final operational checkout of systems such as radio, radar, automatic pilot, fire control, and complete electronic guidance systems. Other skilled workers may specialize in checking out and repairing armament, instruments, rigging and controls, plumbing, and hydraulic systems. In some cases, less skilled mechanics help conduct tests and make repairs.

Materials handling, maintenance, and custodial occupations. Aerospace plants employ large numbers of materials handlers such as truckdrivers, shipping clerks, and tool crib attendants. Maintenance workers, who keep equipment and buildings in good operating condition and make changes in the layout of the plant, include maintenance mechanics, millwrights, electricians, carpenters, and plumbers. Guards, firemen, and janitors make up a major portion of the plant's protective and custodial employees.

Training, Other Qualifications, and Advancement

A college degree in engineering or in one of the sciences usually is the minimum requirement for engineering and scientific jobs in the aerospace industry. A few workers become professional engineers without a college degree, but only after years of semiprofessional work experience and some college-level training. Since many kinds of engineers and scientists are employed in aerospace, college graduates in many different degree fields may qualify for professional jobs. Regardless of his field, the undergraduate preparing for professional aerospace work is advised to get as solid a background as possible in fundamental concepts of engineering and science. Mathematics and physics courses are especially important. Education or training in the more specialized fields of the aerospace industry generally is received in graduate school or on the job.

An increasing number of semiprofessional workers, such as electronics-technicians, engineering aids, and draftsmen take 2 years of formal education in a technical institute or junior college. Others qualify through several years of diversified shop experience.

Training requirements for plant jobs vary from a few days of on-the-job instruction to several years of formal apprenticeship. Apprenticeship programs develop craftsmen such as machinists, tool and die makers, sheetmetal workers, patternmakers, aircraft mechanics, and electricians. These programs vary in length from 3 to 5 years, depending on the trade; during this time, the apprentice handles work of progressively increasing difficulty. Besides on-the-job experience, he receives classroom instruction in subjects related to his craft. Such instruction for a machinist apprentice, for example, would include courses in blueprint reading, mechanical drawing, shop mathematics, trade theory, physics, safe working practices, and other subjects.

Many levels of skill are required for other factory jobs. Workers who have little or no previous training or experience are hired for the less skilled assembly jobs. On the other hand, skilled assemblers may need 2 to 4 years of plant experience in addition to a high school or vocational school education or its equivalent. Skilled assemblers must be able to read and interpret engineering blueprints, schematic diagrams, and production illustrations.

Skilled inspectors often have several years of machine shop experience. They must be able to install and use various kinds of testing equipment and instruments, read blueprints and other specifications, and use shop mathematics. New workers who have little or no experience in shop trades also may be hired and trained for jobs requiring less skilled inspectors.

Mechanics who do the final checkout of aircraft and spacecraft qualify for their jobs in several ways. Many gain experience working in earlier stages of the production line; others receive all their training in checkout work or in "line maintenance" jobs with commercial airlines.

Chief mechanics usually need 3 to 5 years of experience in the manufacture of aircraft, missiles, and spacecraft, including at least 1 year as a checkout mechanic. Specialized mechanics, working under the supervision of the chief mechanic, usually are required to have at least 2 years' experience. Less experienced helpers or assistants learn on the job and through plant training courses.

Because complex and rapidly-changing products require highly-trained workers aware of new developments, most aerospace plants support some kind of formal training to supplement day-to-day experience and help workers advance more rapidly. Many major producers conduct educational and training classes or pay tuition and related costs for outside courses. Some classes are held during working hours in which case trainees are paid for class time; other classes are conducted after working hours. Courses are available for practically every occupational group and cover many skills and areas, for example, blueprint reading, drafting, welding, aircraft maintenance, and electronic data processing. Most trainees take short-term courses to meet immediate needs. Few employees are enrolled in long-term programs, such as apprenticeships.

Employment Outlook

By 1980, employment in aerospace is expected to be slightly above 1970 levels. In addition, tens of thousands of job opportunities will occur annually to replace workers who transfer to other fields of work, retire, or die.

Aerospace products have been developed primarily to assure our national security and to advance our goals in space. Therefore the industry's future depends largely on the level of Federal expenditures. Changes in these expenditures usually have been accompanied by sharp fluctuations in aerospace employment. Many workers, including some scientists, engineers, and technicians, have been laid off during production cutbacks. The outlook in this industry is based on the assumption that defense expenditures (in constant dollars) in the late 1970's will be somewhat higher than the level prior to the Vietnam buildup, approximating the level of the early 1960's. If they should differ substantially, demand for workers will be affected accordingly.

By the late 1970's employment in aircraft manufacturing is expected to be slightly higher than the current level. Reflecting a drop in commercial aircraft sales and a decrease in requirements for the Vietnam War, employment has dropped sharply since 1968. Jobs in the spacecraft field may increase moderately because of increased expenditures for space exploration. Employment in plants that produce electronic units for this industry also should increase.

Expenditures for research and development are expected to rise above current levels. Employment opportunities should be more favorable for highly trained workers, such as engineers and technicians. Many openings will become available in manufacturing, university laboratories, independent research organizations, and Federal agencies, such as the Air Force and NASA.

Some job openings also will become available for skilled plant personnel such as machine repairmen. Because many diversified products are custom made, employment of semiskilled and unskilled assembly line workers is expected to decrease.

Earnings and Working Conditions

Plant workers' earnings in the aerospace industry are higher than those in most other manufacturing industries. In 1970, for example, production workers in plants making aircraft and parts averaged \$168.92 a week or \$4.12 an hour; production workers in all manufacturing industries as a whole averaged \$133.73 a week or \$3.36 an hour. Production workers in the Department of Defense and other Federal agencies receive wages equal to prevailing rates paid for comparable jobs by local private employers.

Earnings of professional and technical workers in the aerospace field are often higher than those for similar workers in other industries.

The following tabulation indicates an approximate range of hourly wages for selected occupations in mid-1970 obtained from the collective bargaining agreements of a number of major aerospace companies; these rates do not include incentive earnings. The ranges in various jobs are wide, partly because wages within an occupation vary according to workers' skills and experience, and partly because wages differ from plant to plant, depending upon type of plant, locality, and other factors.

Aircraft mechanics	\$3.00–4.50
Assemblers	\$2.80–4.00
Electronics technicians	\$3.90–4.80
Heat treaters	\$3.00–4.30
Inspectors and testers	\$3.00–4.90
Jig and fixture builders	\$3.70–4.90
Machine tool operators	\$3.00–4.10
Machinists	\$3.70–4.90
Maintenance craftsmen	\$3.00–4.70
Riveters	\$3.00–3.80
Tool and die makers	\$3.80–4.90
Welders	\$2.90–4.30

Fringe benefits in the industry usually include 2 weeks of paid vacation after 1 or 2 years of service, and 3 weeks after 10 to 12 years. Employees generally get 8 to 10 paid holidays a year and 1 week of paid sick leave. Other major benefits include life insurance; medical, surgical, and hospital insurance; accident and sickness insurance; and retirement pensions. For fringe benefits in Federal aerospace employment, see statement on Federal civilian employment.

Most employees work in modern factory buildings which are clean, light, and airy. Some work out of doors. Operations such as sheetmetal processing, riveting, and welding may be noisy, and some assemblers may work in cramped quarters. Aerospace plants are comparatively safe; the injury-frequency rate in 1969 averaged only about one-third of that for manufacturing as a whole.

Most plant workers in the aerospace field are union members. They are represented by several unions, among them the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; and the International Union of Electrical, Radio and Machine Workers. Some craftsmen, guards, and truck drivers are members of unions which represent their specific occupational groups.

Sources of Additional Information

Additional information about careers in the aerospace field may be obtained from:

National Aeronautics and Space Administration, Washington, D.C. 20546.

Aerospace Industries Association of America, Inc., 1725 DeSales St. NW., Washington, D.C. 20036.

International Association of Machinists and Aerospace Workers, 1300

Connecticut Ave. NW., Washington, D.C. 20036.

International Union, United Automobile, Aerospace and Agricultural Implement Workers of America, 8000 East Jefferson Ave., Detroit, Mich. 48214.

International Union of Electrical, Radio and Machine Workers, 1126 16th St. NW., Washington, D.C. 20036.

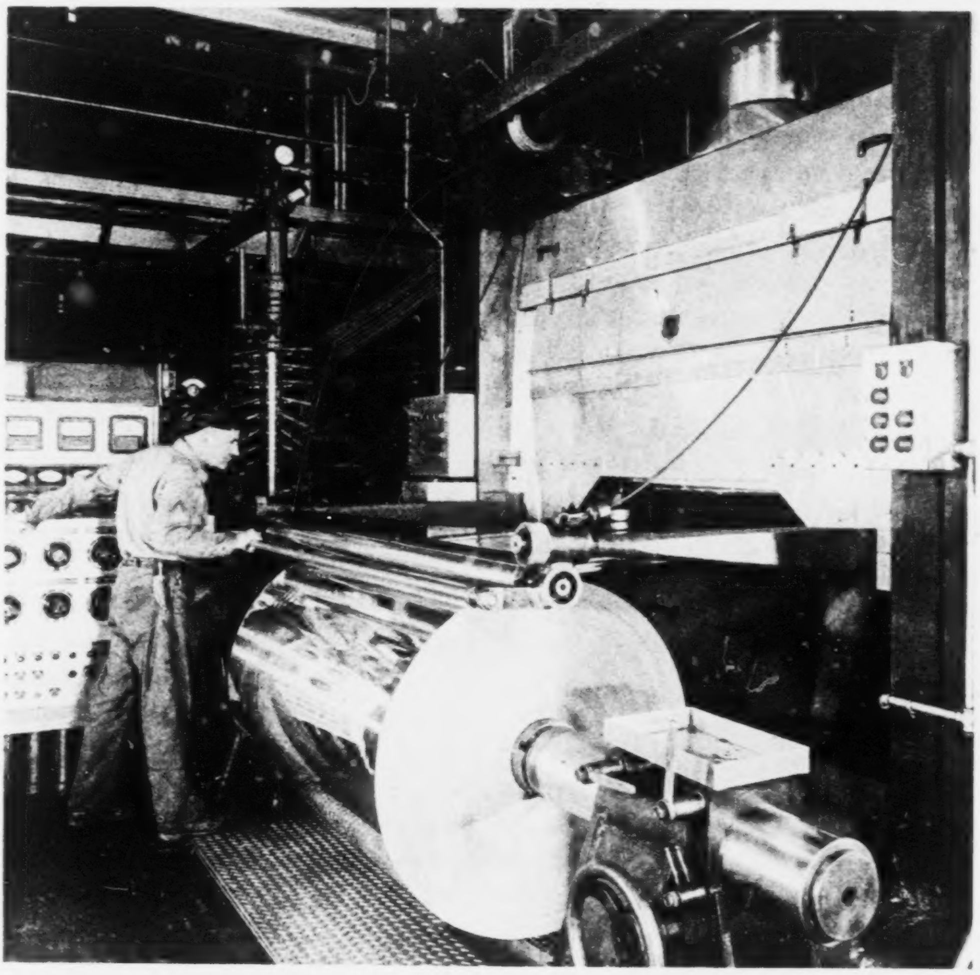
Electronics Industries Association, 2001 Eye St. NW., Washington, D.C. 20006.

EMPLOYMENT OUTLOOK AND OCCUPATIONS IN THE ALUMINUM INDUSTRY

More than 99,000 workers were employed in the aluminum industry in 1970. Employment was concentrated mainly in the rolling and extruding sector, although individual primary reduction plants in some cases employed more workers than rolling and extruding plants.

Considered a specialty metal having limited application only a short time ago, aluminum today is mass-produced in quantities second only to iron and steel. It is used in products ranging from appliances and cooking utensils to automobiles and aircraft and aerospace applications. Aluminum siding, containers, and electrical cables are among the more important applications of this versatile metal. During 1970, the industry produced more than 7.9 billion pounds of primary aluminum or twice the output of only 10 years earlier.

This chapter describes occupations in the primary aluminum industry which comprises plants engaged in producing aluminum and aluminum alloys from aluminum hydrooxide (alumina). It also describes occupations in plants engaged in rolling, drawing, and extruding aluminum and aluminum-base alloys. The so called secondary aluminum industry, which produces aluminum primarily from aluminum scrap, is excluded as are the mining of bauxite, fluorspar, and other raw materials, and the refining of bauxite to alumina. Occupations concerned with casting, stamping, forging, machining, and fabrication of aluminum are discussed separately in the *Handbook* chapters dealing with forging, foundry, and machining occupations.



Rolling mill operator produces aluminum foil.

Some companies that produce aluminum are integrated completely—that is, they operate bauxite mines, maintain a fleet of ships to transfer the ore or alumina to processing plants, refine the ore into alumina, reduce alumina to aluminum, and form aluminum into semifinished and finished products by rolling and a wide variety of fabricating methods. Other companies fabricate metal that they produce but buy alumina from other sources. The great majority of companies do not produce the basic metal, but purchase aluminum from primary or secondary (scrap) sources and form the metal into semifinished and finished products.

The South Central area of the country, which includes Alabama, Arkansas, Louisiana, Tennessee, and Texas, leads in the production of primary aluminum, although the State of Washington is the Nation's largest producer. Plants within its borders represent about one-fifth of national primary aluminum capacity. The North Central area, consisting of Illinois, Indiana, Michigan, and Ohio, is the center for aluminum rolling, drawing, and extruding plants.

Occupations in the Industry

Employment in the aluminum industry falls into several categories. First, there is a wide assortment of jobs directly concerned with smelting and transforming aluminum into industrial and consumer products. Workers in another group of occupations maintain and service the complex machinery and equipment used in the manufacturing process. In addition, a fairly large group of clerical, sales, professional, technical, administrative, and supervisory positions is needed to facilitate the production process and to operate the companies.

About 3 out of 4 workers employed in the industry work in production occupations. They produce aluminum from alumina and form the metal, maintain plant machinery and equipment, and facilitate the flow of materials throughout the plant. The remaining one-fourth are in clerical, sales, professional, technical, administrative, research, managerial, and supervisory occupations.

Women make up only 3 percent of the work force in primary aluminum plants and are employed mostly in secretarial and other clerical occupations. In rolling and drawing plants, on the other hand, women make up 10 percent of the work force and are found in clerical and other occupations, such as sorter and inspector.

Processing Occupations

The largest proportion of employees in the aluminum industry are in factory jobs processing the metal. To illustrate the types of processing occupations found in the industry, a description of the major steps in the production (reduction) and fabricating of aluminum follows.

To produce aluminum, the metal is separated by electrolysis from the oxygen with which it is combined in alumina. This process involves mixing alumina and other additives in a bath of cryolite (sodium aluminum fluoride) and occurs in deep rectangular cells or "pots" of thermally insulated steel, lined with carbon. The cells or furnaces are generally about 20 feet long, 10 feet wide, and about 3 feet deep.

Reduction—The cells containing molten cryolite are lined with carbon which serve as the cathode or one electrode. Depending on the type of cell used, either one large block of carbon (Soderberg) or a number of small blocks of carbon (prebaked) suspended from the top of the cell acts as the anode or other electrode. Direct electrical current is introduced, and the alumina is reduced to aluminum and accumulates at the bottom of the cell. The oxygen is deposited on the anode and is oxidized to carbon dioxide.

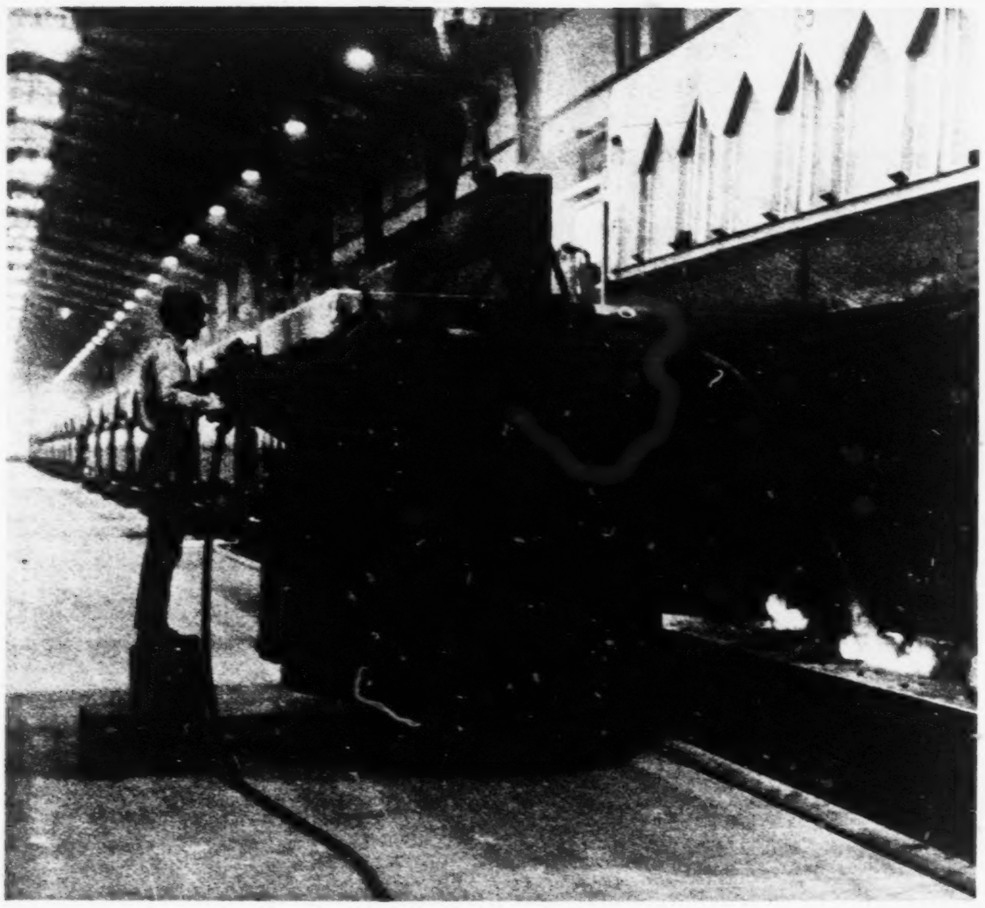
Anode men (D.O.T. 630.884) are responsible for maintenance of the anodes on the reduction cells. Among their duties are pulling pins from the anodes by means of hydraulic pullers and cleaning scales from the pins using a sandblasting device. They may replace the pins using a steel driver.

Pot liners (D.O.T. 519.884) rebuild the Soderberg type anode and reline the reduction furnaces when they burn out. To line the pot, the pot liners pour water into it to loosen the sediment. They then dig out the material using jackhammers or diggers. Next, they lay a brick base in the pot floor and drop carbon mix into the cell. The potliners line the walls and floor with carbon blocks and tamp carbon paste into cracks using a pneumatic hammer.

Potmen (D.O.T. 512.885) tend the reduction pots and are responsible for their continuous operation. Each potman attends a number of different cells. During the operation of the pot, the alumina gradually is consumed. When the dissolved alumina content of one of the cells decreases from approximately 5 percent to 2 percent of the electrolyte, the electrical resistance of the pot rises suddenly from about 5 to 30 volts or more causing an electric bulb on the side of the pot to light. This development, known as "anode effect," signals the potman to break the crust of the electrolyte bath and stir in hot alumina which has been laying on the surface. This operation causes the voltage to return to normal levels and the crust re-forms. In operating the pots, operators try to reduce anode effects by adding specified amounts of materials at designated time intervals.

Every 24 to 72 hours, part of the molten aluminum is syphoned from the bottom of the reduction cells into huge cast-iron crucibles which have airtight lids. *The tapper* (D.O.T. 514.884) and *tapper helper* (D.O.T. 514.887) signal the *hot-metal crane operator* (D.O.T. 921.883) to place the overhead crane near the pot to be tapped. They then break a hole in the electrolytic crust by using an automatic pot puncher. One end of a curved cast iron tube is inserted into the pot, the other into a crucible of up to 8,000 pounds capacity. A compressed air hose is attached to the siphon and the molten metal is drawn into the crucible. After the completion of several tappings, an overhead crane removes the loaded crucible to a remelting or holding furnace.

A *scaleman* (D.O.T. 502.887) weighs and samples the molten metal for laboratory analysis, and separates grades and types of alloys to be blended with the molten aluminum. The molten metal in the crucibles is poured into a "charging hearth" or remelt furnace. A *remelt operator* (D.O.T. 512.885) adds



Tapper directs aluminum from potline.

specified portions of aluminum scrap and molten metal from other crucibles. Other metals are added (alloying) to the furnace to obtain desired properties.

Final steps in the preparation of the metal are fluxing and degassing. A compound is added to flux the molten metal and force oxides of aluminum to the surface for a hand skimmer to remove. Before the molten metal is removed from the charging furnace, nitrogen or chlorine gas is added to eliminate the hydrogen gas.

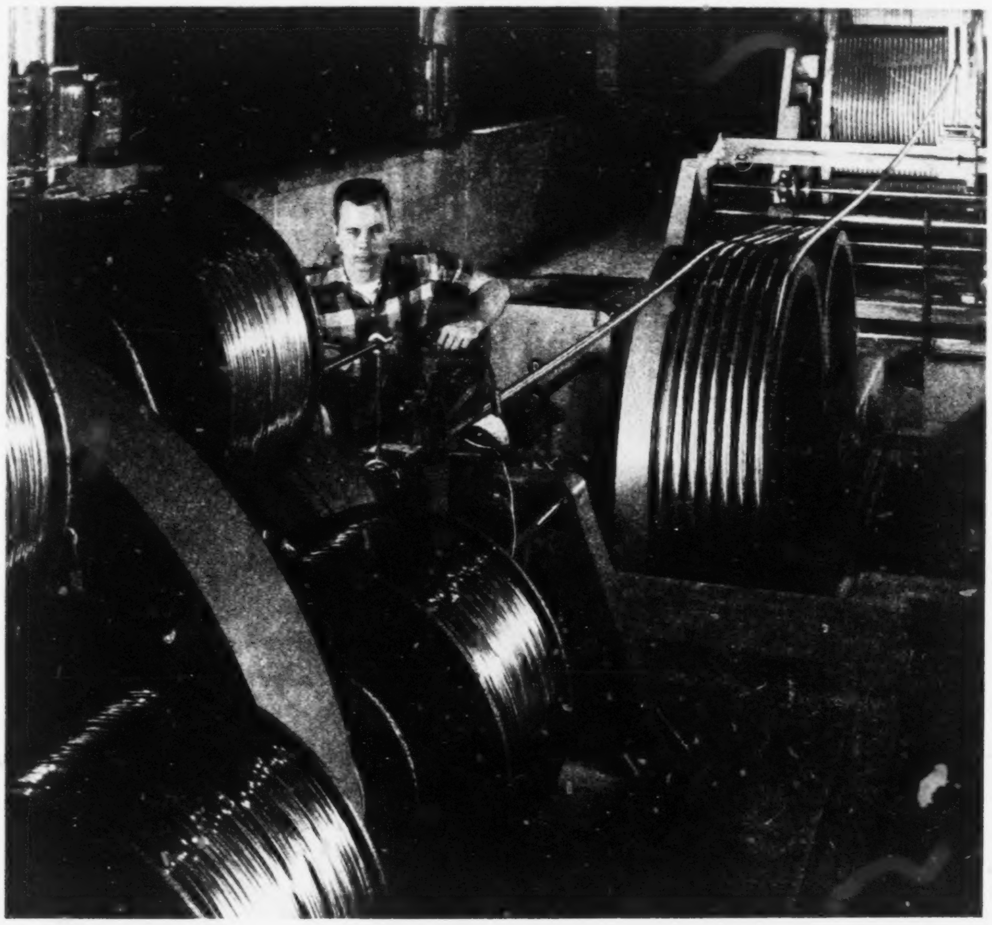
After the alloying and fluxing processes, the metal is transferred to the second compartment of the furnace, the "holding" section, until a sufficient supply is obtained for pouring. The *d.c. casting operator* (D.O.T. 514.782) has charge of the pouring station in which the molten metal is cast into ingots. He controls the cooling condition of the casting unit by maintaining a constant level of metal in the molds and operates a series of instruments which spray water against the molds to produce ingots of uniform crystal-line structure.

Rolling—Over half of aluminum wrought products consist of plate, sheet, and strip, which are produced by rolling. The first step in rolling operations is to remove surface impurities from the ingot. *The scalper operator* (D.O.T. 605.782) manipulates levers of a scalper machine and cuts approximately one-fourth inch layers of metal from the ingots. To improve corrosion resistance of the surface, ingots are sometimes clad with thin layers of high purity aluminum. These layers which are clamped on the sides of the ingot join with the central layer of the sheet during the rolling process. The ingots are brought to proper working temperatures for rolling by heat treating. Overhead cranes lower the ingot vertically into furnaces, or "soaking pits," where they are kept hermetically sealed for 12 to 18 hours. The *soaking pit operator* (D.O.T. 613.782) manages the furnace and sets controls to adjust temperature and heating time.

The huge rolling ingots are positioned on the "breakdown" or hot rolling mill where they are converted into elongated slabs of aluminum. Reduction operations are controlled by trained *rolling mill operators* (D.O.T. 613.782) who manipulate the ingots back and forth between powerful rollers of a large tandem hot reversing mill until they are reduced in thickness to about 3 inches. The slabs then move down the line on rollers to additional hot mills where they are worked down to about one-eighth of an inch thick. At the end of the hotline, a *coiler operator* (D.O.T. 613.885) tends a coiler which automatically winds the metal onto reels.

Coiled aluminum is cooled at room temperature and then cold rolled to a still thinner size. Cold rolling assures a better surface finish and increases the metal's strength and hardness. Since continual cold rolling could make the metal too brittle, intermediate steps of heat treating are necessary. Heat treating (annealing) takes place in furnaces under the control of an *annealer* (D.O.T. 504.782).

After annealing, the metal may be further cold rolled to a specified thickness and again heat treated to soften it for future fabrication. To relieve internal stress from rolling and annealing or contour defects, the



Cable mill worker operates machines and strands aluminum wire into thick electrical tape.

finished sheet or plate may be placed in large stretchers which pull the metal from end to end. *Stretcher-leveler-operators* (D.O.T. 619.782) and *stretcher-leveler-operator helpers* (D.O.T. 619.886) position the metal in a stationary vise, determine stretch requirements to meet production specifications, and operate the machine.

During both the production and fabricating processes, the metal is inspected to assure quality and consistency. Radiographic testing and ultrasonic testing are two processes used for inspection. *Radiographers* (D.O.T. 199.381) operate various types of X-ray equipment to take radiographs of the metal. Computers monitor operations and adjust any differences that may occur between scheduled temperatures, diameter of metals, and speed of operations.

Fabrication of Rods, Bars, and Structurals—In the rod and bar mill, square castings called "blooms" are heated to make them softer and then rolled through pairs of openings, each progressively smaller, until the proper size is reached. To produce wire, hot rolling is continued until the rod is about three-eights of an inch in diameter. Then it is cold-worked and drawn through dies which have openings smaller than the rod to reduce cross-sectional dimensions. *Wire draw operators* (D.O.T. 614.782) operate machines which draw the wire through the series of dies and automatically coil it on revolving reels.

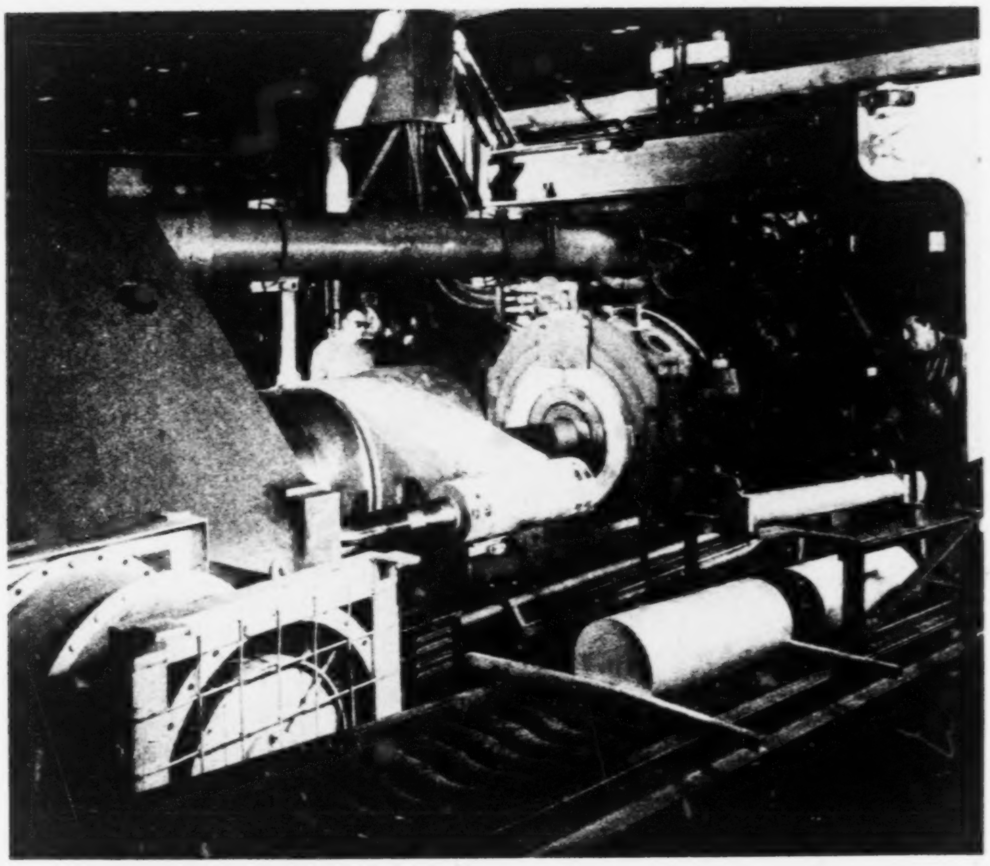
Structural shapes such as I beams and angles may be hot rolled or extruded. Hot rolled structurals are made by passing a square bloom with rounded corners between rolls having a series of grooves. As the grooves become smaller, the bloom is reduced in cross section and elongated. The shape of the structural is determined by the contour of the grooves in the rolls.

Extrusion. Extruding of metal often is compared with squeezing toothpaste from a tube. Extruded aluminum shapes are produced by placing heated billets (aluminum logs) in an enclosed cylinder in a powerful press. A hydraulic ram which usually has a force of several million pounds pushes the metal through a design cut in a die at the other end of the cylinder. The metal takes the contour of the die in cross-section and then may be cut into desired lengths. By designing different dies, almost any shape of aluminum product may be formed. The press is operated by an *extrusion press operator* (D.O.T. 614.782) who regulates the rate of extrusion to prevent metal rupture and adherence of metal to contour walls.

Another type of extrusion is impact extrusion, a combination of extrusion and forging. Shapes of aluminum are inserted in dies of powerful presses. A punch gives the slug a forceful downward blow, and the metal of the slug is forced around the punch. The production process is basically complete in the one blow.

Maintenance, Transportation and Plant Service Occupations

Large numbers of workers are employed in the aluminum industry to keep machines and equipment



Workers check aluminum being shaped by extrusion press.

operating properly. Others are engaged in moving materials, supplies, and finished products throughout the plants; still others are employed in service occupations such as guard, policeman, and custodian. Many of these occupations also are common to other industries. (See index to the *Handbook.*)

The critical importance of electricity to the reduction process requires a relatively large number of *electricians* to install electrical wiring and maintain electrical fixtures, apparatus, and control equipment. *Electronics mechanics* repair computers, industrial controls, radiography equipment, and other complex electronic gear.

Millwrights move, maintain, and repair mechanical equipment. They take apart and restore to operating use machinery essential to aluminum production and fabrication. *Maintenance machinists* are employed in plant machine shops to make and repair mechanical parts used in the plant machinery and equipment. *Stationary engineers* operate and maintain the powerplants, turbines, steam engines, and motors used in aluminum plants.

Diemakers lay out, assemble, and repair dies used in aluminum metalworking operations. *Bricklayers* build, rebuild, and reline boilers, furnaces, soaking pits, and similar installations. *Plumbers and pipefitters* lay out, install, and maintain piping and piping systems for steam, water, and industrial materials used in aluminum manufacture. *Maintenance welders* join metal parts by hand or machine riveting and by resistance welding and electric arc and gas welding.

Professional, Technical, and Related Occupations

Engineers, scientists, and technicians make up a significant proportion of nonproduction worker employment in the industry.

Quality control is essential in producing aluminum. Companies employ quality control *chemists* to analyze the aluminum and the raw materials used in its production. *Process metallurgists* determine the most efficient methods of producing aluminum from raw materials. *Physical metallurgists* conduct microscopic, X-ray, spectroscopic, and physical and mechanical property tests of aluminum and alloys to determine their physical characteristics. They also develop new alloys and new uses for aluminum and alloys.

Chemical engineers and mechanical engineers design and supervise the construction and operation of reduction and fabricating facilities. Most mechanical engineers are employed in the fabricating sectors of the industry, where they may design, regulate, and improve rolling mills and related equipment.

Electrical engineers plan and oversee the installation, operation, and maintenance of the electric generators, transmission, and distribution systems used in the manufacture of aluminum.

Industrial engineers conduct work measurement studies, develop management control systems to aid in financial planning and cost analysis, and, in general, determine the most effective methods of using the basic factors of production: manpower, machines, and materials.

Engineering technicians, laboratory technicians, and chemical analysts assist engineers and chemists in research and development work. *Draftsmen* prepare the working drawings that are required for the manufacture and repair of reduction and fabricating machinery.

A wide range of other professional and administrative occupations is needed to facilitate the manufacture of aluminum. Top executives manage the companies and determine policy decisions. Middleline managers and superintendents direct individual departments, offices, and operations. The industry also employs accountants, lawyers, statisticians, economists, and mathematicians, and other administrative personnel.

Clerical and Related Occupations

A large group of clerical workers, including bookkeepers, secretaries, stenographers, clerk typists, and keypunch and computer operators keep records for the company and transact everyday business.

Training, Other Qualifications, and Advancement

Aluminum companies generally hire and train inexperienced workers for processing and maintenance jobs. For most professional occupations, the minimum requirement is a bachelor's degree. For research and development work, most companies prefer graduate degrees. Administrative and managerial positions usually are filled by people who have engineering or other specialized backgrounds and have been promoted to such jobs. Sales positions often are filled by people having engineering or related technical backgrounds.

Applicants and employees who demonstrate a capacity for technical work have opportunities to qualify as technicians, laboratory assistants, and other semiprofessionals. Some college background in science or graduation from a technical institute or community college is required for many technical jobs.

Some jobs in the industry can be learned in a few days; craft, engineering, and scientific positions require years of preparation. New, unskilled workers often begin their careers in labor pools from which they are assigned to fill in for regular workers who are absent. After working in the pool for a specified period, they become eligible for a permanent position in a shop or department. As workers acquire additional skills and seniority with the company, they usually move to more responsible and better paying positions. Former production and maintenance workers fill many foremen and supervisory positions.

Craftsmen are trained most often on the job. A number of companies, particularly the larger ones, have apprenticeship programs. Under these programs, apprentices take related instruction courses in classrooms or at home and also work with experienced craftsmen to obtain practical on-the-job experience. The length of the apprenticeship varies according to the requirements of the particular craft, although most require 3 or 4 years. The following crafts are included among the apprenticeship programs currently in force in the industry: electrician, welder, brickmason, carpenter, pyrometer man, machinist, maintenance mechanic, pipefitter, diemaker, roll grinder, sheet-metal worker, and automotive mechanics. Generally, candidates for programs are chosen from promising young men already employed by the company.

Employment Outlook

Employment in the industry is expected to rise moderately through the 1970's, although the amount of aluminum produced annually is likely to increase much more rapidly. Most job opportunities will stem from the need to replace workers who retire, die, or leave the industry for other reasons. Openings arising from deaths and retirements alone are expected to average several thousand a year.

Demand for aluminum is expected to continue to grow at a fast rate because of its natural properties and the industry's aggressive marketing program. Moreover, industries that represent major markets for aluminum are growing industries with potential for new product development. For example, motor vehicle manufacturers are expanding the use of the metal in automobile components, and virtually the entire bodies of many trucks and buses are made of aluminum. Aluminum is being used widely in the construction of large office and institutional buildings and for residential construction and remodeling. To take advantage of this potential, the aluminum industry supports a strong research and development program which should continue to develop new alloys, processes, and products. As a result, the number of engineers, scientists, and technical personnel is expected to increase as a proportion of total employment. On the other hand, larger cell and plant capacities and technological developments, such as continuous casting and computer controlled rolling operations, will limit employment growth among some production occupations.

Earnings and Working Conditions

Earnings of plant workers in the aluminum industry are higher than the average for other manufacturing industries. For example, in 1970, production workers in primary aluminum plants averaged $167.69 a week or $4.09 an hour for a 41.0 hour week. Production workers in aluminum rolling and drawings plants averaged $154.84 a week or $3.74 an hour for a 41.4 hour week. This compared with average earnings of $133.73 per week or $3.36 an hour for a 39.8 hour week for production workers in all manufacturing.

Skilled operators and skilled maintenance and craft workers hold the highest paying plant jobs. Standard hourly rates effective in early 1971 for selected occupations in a number of plants of a large aluminum producer are shown as follows:

Occupation	*Hourly wage rate*
Reduction:	
Laborer	$ 3.092
Scaleman	3.482
Industrial trucker	3.417
Soaking pit operator	3.547
Annealing furnace operator	3.612
Potman	3.687
Pourer	3.417
Tapper	3.947
Fabricating:	
Mill helper	3.157
Stretcher-leveler operator	3.547
Scalper operator	3.547
Inspector	3.612
Hot mill operator	4.067
Continuous mill operator	4.132
4-Hi mill operator	4.132
Maintenance:	
Boiler fireman	3.872
Carpenter	4.197
Welder, pipefitter, millwright	4.262
Layout man	4.392
Electrician, machinist, pyrometer man	4.459

In addition to the above rates, premium pay is given for over-time work and for work on Sundays and holidays. Aluminum workers also receive other benefits, such as paid vacations and holidays; retirement benefits; life, sickness and accident hospital, medical and surgical insurance; shift differentials; supplemental jury pay; and supplemental unemployment benefits. Most workers receive vacation pay ranging from 1 to 4 weeks, depending on length of service. In addition, an extended vacation plan provides 13-week vacations (including regular vacation time) every 5 years.

Salaried personnel generally receive benefits comparable to those for hourly employees. Starting salaries are determined by the job being filled, the applicant's qualifications, comparable area and industry wage scales, and the structure of the hourly pay scale at the plant. Graduates of accredited colleges receive good starting salaries, and engineering graduates usually receive the highest offers.

The reduction of alumina to aluminum requires high temperatures. The potroom is often hot, dusty, and smoky. In recent years working conditions in reduction plants have been improved as a result of fume control programs and other projects. The fabricating side of the industry offers more favorable work conditions though workers in certain jobs are subject to high temperatures, noises, and other discomforts. Maintenance shops offer favorable working atmosphere. Because aluminum reduction is a continuous operation, some workers are required to work at night and on weekends.

The industry stresses safe working conditions and conducts intensive programs of worker safety education. For example, reduction plants have had a consistently lower frequency rate of injuries per man-hour than in other primary nonferrous metal smelting and refining plants.

Most process and maintenance workers in the aluminum industry belong to labor unions. In addition, labor organizations represent some office, technical, and security personnel. The unions having the greatest number of members in the industry are United Steelworkers of America; Aluminum Workers International Union; and International Union, United Automobile, Aerospace and Agricultural Implement Workers of America.

Sources of Additional Information

The Aluminum Association, 750 Third Ave., New York, N.Y. 10017.

OCCUPATIONS IN THE APPAREL INDUSTRY

The apparel industry is an important source of jobs for a range of workers who have widely different skills and interests. Many of the jobs in this industry can be learned in a few weeks; others take several years.

The apparel industry is the Nation's largest employer of women in manufacturing. Four out of five garment workers are women. Most sewing machine operators are women. However, many others work in jobs such as hand sewer and designer. Men usually predominate in jobs such as cutter and marker, presser, production manager, engineer, and salesman.

Nature and Location of the Industry

About 1.4 million men and women were employed in the apparel industry in 1970. Approximately 624,000 produced women's and children's apparel and about 506,000 men's. Among women's and children's garment workers, about 432,000 workers made dresses, skirts, blouses, suits, and coats for women and girls and another 118,000, undergarments for women and children. In the men's apparel industry, 126,000 workers produced tailored clothing (suits, overcoats, topcoats, and sportcoats) for men and boys and 380,000 made men's and boys' shirts, slacks and trousers, work clothes, nightwear, undergarments, and other furnishings. Another 92,000 made such items as fur goods, raincoats, hats, gloves, and dressing gowns. About 163,000 workers produced curtains and draperies.

Although apparel factories are located in nearly all States, approximately 7 out of every 10 of the workers are employed in 10 States: New York, Pennsylvania, New Jersey, California, Georgia, Tennessee, North Carolina, Texas, Massachusetts and South Carolina.

In women's outerwear manufacturing—of dresses, blouses, skirts, suits, and coats—almost one-half of the workers were employed in plants located in the New York-Northeastern New Jersey metropolitan area and in areas of Pennsylvania such as Wilkes–Barre–Hazelton, Allentown–Bethlehem–Easton, and Philadelphia. However, many jobs for workers manufacturing women's outerwear also are found in Los Angeles–Long Beach and San Francisco, California; Fall River–New Bedford, Massachusetts; Miami, Florida; Dallas, Texas; Chicago, Illinois; and St. Louis, Missouri.

In the men's and boy's tailored clothing industry—suits, coats, and overcoats—the majority of jobs are in metropolitan centers, namely; Philadelphia, New York City, Baltimore, Chicago, Rochester–Buffalo, Cleveland, Boston, St. Louis, Los Angeles–Long Beach, Knoxville, and Cincinnati. In manufacture of men's, youths' and boys' furnishings such as work clothing and shirts, and undergarments for women and children, most jobs are located in the South, Southwest, and Central Atlantic states, primarily in small communities.

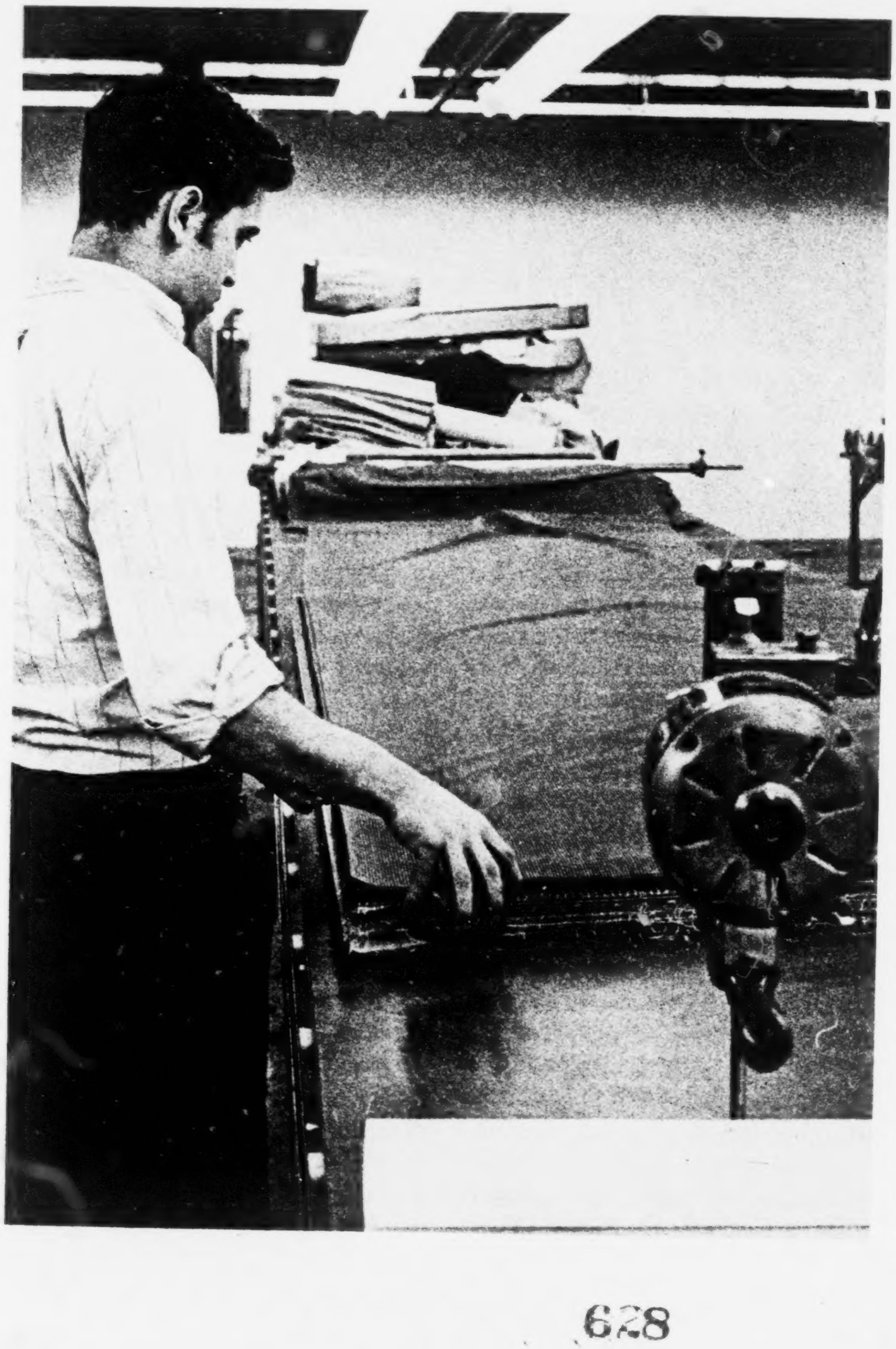
Most apparel factories are small. Although plants have been growing larger in recent years, only about one out of seven of them employ more than 100 workers. Many of the large plants make men's and boys' apparel. Plants that manufacture garments that are subject to rapid style change tend to be smaller than those making standard-type garments such as work pants.

Occupations in the Industry

The major operations in making apparel are designing the garment, cutting the cloth, sewing the pieces together, and pressing the assembled garment. Generally, high-grade apparel and style-oriented garments are more carefully designed and involve more handwork and fewer machine operations than the cheaper, more standardized garments. For example, much hand-detailing goes into a woman's high-priced fashionable cocktail dress or into a man's high-priced suit or coat. In contrast, standardized garments such as men's undershirts, overalls, and work shirts usually are sewn entirely by machine. To make the many different types, styles, and grades of garments, workers with various skills and educational backgrounds are employed in the apparel industry.

Designing Room Occupations. Typically, the manufacturing process begins with the *designer* (D.O.T. 142.081) who creates original designs for new types and styles of apparel. The designer usually works with one type of apparel, such as men's suits or women's dresses. Due to some manufacturers who have diversified, especially in sportswear, designers work with more than one type of apparel. For women's apparel, the designer may get ideas by visiting museums, libraries, and major fashion centers in both the United States and Europe. The designer makes sketches of his designs and presents them to the management and sales staff of his company for approval. The sketches include information about the type of fabric, trim, and color. In designing women's or children's garments, he may make an experimental garment in muslin from approved sketches. He cuts, pins, sews and adjusts the muslin on a dress form or on a live model until the garment matches his sketch. In large manufacturing plants, a *sample stitcher* (D.O.T. 785.381) prepares these sample garments by following the designer's sketch and performing all necessary machine and hand sewing operations.

Since designing is a creative job, designers usually work without close supervision, but they must produce a satisfactory number of successful styles during a season, especially when designing women's fashion garments. A large garment manufacturer generally has one designer and several assistants who often have specialized designing responsibilities of their own. Many small plants and plants making standardized garments do not employ designers but purchase ready-made designs or patterns.



When the sample garment or sketch has been approved, it is sent to a *patternmaker* (D.O.T. 781.381) who constructs a full-size master pattern. Working closely with the designer, the patternmaker translates the sketch or sample garment into paper or fiberboard pattern pieces to be used as guides for cutting fabric. In drawing and cutting pattern pieces, the patternmaker must make allowances for pleats, tucks, yokes, seams and shrinkage. In some shops designers or all-round tailors make patterns; in others, the assistant designer performs the patternmaking tasks.

The master pattern serves as a guide for the *pattern grader* (D.O.T. 781.381) who makes a wide range of sizes in each garment style. In a sense, the pattern grader is a specialized draftsman. He measures the pieces that make up the master pattern and modifies them to fit all sizes. The pattern grader then outlines each revised pattern piece on fiberboard and cuts out the pieces by following the outlines. After he completes a set of pattern pieces for each garment size, he attaches a label to identify the part and size of the garment. Some large plants use computers to reduce the length of time required to draw up the pattern for each garment size from the master pattern.

Cutting Room Occupations. Workers in the cutting room prepare cloth for sewing into articles of wearing apparel. There are five basic operations in the cutting department: spreading marking, cutting, assembling, and ticketing. Small shops may combine two or more of these operations into a single job. Most jobs in the cutting room are held by men.

Marker traces outline of pattern.

Hand spreaders (D.O.T. 781.887) lay out neat bolts of cloth into exact lengths on the cutting board. *Machine spreaders* (D.O.T. 781.884) are aided by machines in laying the cloth evenly back and forth across the table.

In most plants, *markers* (D.O.T. 781.484) trace the fiber-board pattern pieces on large sheets of paper and make several carbons of these tracings. Some plants that make men's and boys' suits and coats trace the pattern pieces with chalk directly on the cloth itself, rather than on paper. To get the greatest number of cuttings from a given quantity of cloth, markers arrange pattern pieces so that there is just enough distance between them for the cutter to work. Plaids, stripes, and other patterned fabrics must be marked so that adjoining garment parts will match when the garment is assembled. Before making the full-size paper markers, larger plants may photograph miniature patterns which have been arranged in acceptable positions to minimize fabric waste.

Cutter directs electrically powered cutting knife.

A *cutter* (D.O.T. 781.884) cuts out the various garment pieces from the layers of cloth which are spread on the cutting table. He follows the outline of the pattern on the cloth with an electrically powered cutting knife which cuts through all the layers at once. Sometimes layers of cloth are as high as 9 inches. The work of a cutter and a marker frequently is combined into a single job of cutter-marker.

The pieces of cloth that have been cut are prepared for the sewing room by another group of specialized workers. *Assemblers*, sometimes called *bundlers* or *fitters*, (D.O.T. 781.687) bring together and bundle garment pieces and accessories (linings, tapes, and trimmings) needed to make a complete garment. They match color, size, and fabric design and use chalk or thread to mark locations for pockets, buttonholes, buttons, and other trimmings. They identify each bundle with a ticket, which is also used to figure the earnings of workers who are paid for the number of pieces they produce. The bundles are then routed to the various sections of the sewing room.

Sewing Room Occupations. Almost half of all apparel workers are handsewers and machine stitchers. Most of the employees in these jobs are women. The quality and style of the finished garment usually determine how much hand sewing is involved. Generally, higher priced

clothing, such as suits and coats, require more hand sewing than do standardized garments. In the average plant, however, the work is broken down into a large number of machine operations. Some hand sewing is done when the garment nears completion.

Sewing machine operators (D.O.T. 787.782) use sewing machines that are generally heavier and capable of faster speeds than the sewing machines found in the home. Special devices or attachments that hold buttons, guide stitches, or fold seams are often used. Sewing machine operators generally specialize in a single operation such as sewing shoulder seams, attaching cuffs to sleeves, or hemming blouses. Some make garment sections such as pockets, collars, or sleeves; others assemble and join these completed sections to the main parts of the garment. Sewing machine operators employed in shops making high priced dresses and women's coats and suits may perform all the machine operations on a garment.

Sewing machine operators generally are classified by type of machine they use, such as single-needle sewing machine operator or blindstitch machine operator, and by the type of work performed, such as collar stitcher or sleeve finisher.

Most hand sewing is done on better quality or highly styled dresses, suits and coats to produce garments for better fit. Hand sewers (D.O.T. 782.884) use needle and thread to perform various operations ranging from simple sewing to complex stitching. Many hand sewers specialize in a single operation, such as lapel basting or lining stitching.

In a typical apparel plant, bundles of cut garment pieces move through the sewing department, where the garments take form as they pass through a series of sewing operations. Each operator performs one or two assigned tasks on each piece in the bundle and then passes the bundle to the next operator. Many plants employ material handlers (D.O.T. 929.887) often called floor boys or floor girls who move garment bundles from one sewing operation to another.

At various stages of the sewing operations, *inspectors* and *checkers* (D.O.T. 789.687) examine garments for proper workmanship. They mark defects such as skipped stitches or bad seams, which are repaired before the garments are passed on to the next sewing operation. Inspectors sometimes make minor repairs. *Trimmer, hand* (D.O.T. 781.887) often called thread trimmers and cleaners, remove loose threads, basting stitches, and lint from garments. This is called "in-process inspection."

Tailoring Occupations. Tailors (D.O.T. 785.381 and .261) and *dressmakers* (D.O.T. 785.361) are able to make garments from start to finish by hand or by machine. Some skilled tailors who are employed in plants to make men's, women's, and children's outer garments may make up sample garments from the designer's specifications.

Bushelmen (D.O.T. 785.281), repair defects in finished garments that were rejected by the inspector. They alter garment parts that have not been sewn correctly, rearrange padding in coats and suits, and do other sewing necessary to correct defects.

Pressing Occupations. The shape and appearance of the finished garments depend, to a large extent, on the amount of pressing that is done during and after sewing operations. Pressing is particularly important in making high-quality garments. For example, from time to time during the sewing of suits, coats, and better quality dresses, seams are pressed open in order to produce a better fitting and neater garment and to make it easier to assemble the garment. This is called "under-pressing." In the manufacture of lighter weight garments, on the other hand, pressing is done only after completion of all the sewing operations.

Pressers (D.O.T. 363.782, .884, and .885) use various types of steam pressing machines, and may work with manikins and body forms, or use hand irons to flatten seams and to shape garment parts and finished garments. Pressers may specialize in one type of pressing or ironing. For example, in a shirt factory, a *collar pointer* (D.O.T. 583.885) operates a pressing machine that shapes and presses points of shirt collars.

There are two basic types of pressers—underpressers and finish pressers. Underpressers specialize on particular garment parts, such as collars, shoulders, seams, or pockets. Their duties vary from simple smoothing of cloth and flattening of seams to skillful shaping of garment parts. Finish pressers generally do final pressing and ironing at the end of the sewing operations.

Fur Shop Occupations. The apparel industry includes plants that manufacture garments made of fur. Because furs are expensive and difficult to work with, each operation in making a fur garment requires skilled handwork by an experienced craftman. Many of these workers have special skills not found in plants that make other types of apparel.

The most skilled job in a fur garment manufacturing plant is that of a cutter who sometimes is also the foreman in the shop. A *fur cutter* (D.O.T. 783.781) selects and matches enough fur skins to make a single garment, such as a fur coat or jacket. He arranges and cuts the skins on pattern pieces so that the choice sections of fur are placed where they will show. Following the sewing instruction given by the cutter, *fur machine operators* (D.O.T. 787.782) stitch these pelts together to form the major garment sections. A *fur nailer* (D.O.T. 783.884) wets the sewn garment sections, stretches them by hand, and nails them on a board so that they will cover the pattern. When the sections are dry, the nailer removes the nails and trims the fur exactly along the outline of the pattern. The fur machine operator then finishes sewing the various sections together to make the complete garment. *Fur finishers* (D.O.T. 783.381) sew in the lining, tape edges, make prockets and sew on buttons and loops.

Administrative, Sales and Maintenance Occupations. The majority of the administrative positions in an apparel plant are in the production department. The production manager occupies a strategic position in apparel firms. He is responsible for estimating production costs, scheduling the flow of work, hiring and training workers, controlling quality, and supervising the overall production activities of the plant.

The industrial engineer advises management about the efficient use of machines, materials, and workers. (Further discussion of industrial engineers is included elsewhere in the *Handbook*.)

Clerks, bookkeepers, stenographers, and other office workers make up payrolls, prepare invoices, keep records, and attend to other paperwork required in this industry. In some larger plants, many clerical functions are being handled with computers. This requires keypunch operators, computer programers and operators, and systems analysts. Salesmen, purchasing agents, models, credit managers, and accountants are among other types of workers in the apparel industry. Sewing machine mechanics are responsible for keeping the industry's large number of sewing machines in good running order. (Discussions of many of these jobs can be found elsewhere in the *Handbook.*)

Training, Other Qualifications, and Advancement

Training requirements for production (plant) jobs in the apparel industry range from a few weeks of on-the-job training to several months of training and experience. The difference in training time needed before an employee can reach his maximum speed and efficiency depends on the type of job, the worker's aptitude, and the employer's training program. Many plant workers pick up their skills while working as helpers or assistants to experienced workers. Apprenticeship is infrequent and is limited mainly to designing, cutting, or tailoring jobs. Some private and public schools in garment manufacturing centers offer instruction in occupations such as designing, patternmaking, and cutting, as well as sewing by machine and by hand.

Good eyesight and manual dexterity are essential for most production jobs in the apparel industry. Many occupations are well suited for handicapped workers since most jobs are performed while the worker is seated. Little physical exertion is required. Older workers and women also perform well in a variety of jobs. Many workers in their fifties and sixties are among the most skilled and productive. Women are employed in most of the occupations in this industry, although men hold most of the cutting, tailoring, and pressing jobs.

Designers enter the industry in various ways. Many receive their training by working on the job with experienced designers, by advancing from cutting or patternmaking jobs, or through apprenticeship. There is an increasing tendency for apparel firms to recruit designers from colleges that offer specialized training in design. Some young people with a background in designing may take jobs as designers with small firms, and once their reputations have been established, transfer to jobs in larger, better paying firms. In large firms, young people may start as assistant designers.

A designer should have artistic ability, including a talent for sketching, a thorough knowledge of fabrics, a keen sense of color, and the ability to translate design ideas into a finished garment. He should also be acquainted with garmentmaking techniques which he may learn by working briefly at various operative jobs, such as machine sewing, draping, sample making, and cutting.

The production manager usually begins as a management trainee, and the industrial engineer as a junior engineer. A college education is increasingly being required for these jobs. For those without this educational background, many years of on-the-job training in all production processes, ranging from selection of fabrics to shipment of finished apparel, are often required to qualify as a production manager.

Most patternmakers pick up the skills of the trade by working for several years as helpers to experienced patternmakers. Pattern graders and cutters are occasionally promoted to patternmaking jobs. Patternmakers must have the ability to visualize from a sketch or model, furnished by the designer, the size, shape, and number of pattern pieces required. Patternmakers must also have a detailed understanding of how garments are made as well as a knowledge of body proportions. Like the designer, they must also have a thorough knowledge of fabrics.

Pattern graders usually are selected from employees working in the cutting room or in other plant jobs. Training in drafting is helpful since much of the work requires the use of drafting tools and techniques.

Most workers enter the cutting room by taking jobs as assemblers (bundlers or fitters). Patience and the ability to match colors and patterns are necessary qualifications for these jobs. Assemblers (bundlers, or fitters), may be promoted to jobs such as spreader. Several years of experience in the cutting room are required before an employee can become a skilled marker or cutter. A small number of the larger plants have apprenticeship programs which usually last 4 years and include training in spreading, cutting, marking, and patternmaking.

Entry into beginning hand- or machine-sewing jobs is relatively easy for young women, since there are few restrictions regarding education and physical condition. Some previous training in sewing operations is preferred, but many apparel plants hire workers who have had no experience in sewing. Generally, training is informal and received on the job. New workers usually start by sewing straight seams, under the supervision of a section foreman or experienced worker.

Some large companies have formal on-the-job training programs for sewing machine operators. Training usually consists of learning how to perform a single operation with minimal finger, arm, and body movements.

Most sewing jobs require the ability to do routine work rapidly. The same sewing operation is repeated on each identical garment piece. Since almost all these workers are paid on the basis of the number of pieces produced, any clumsiness of hand may reduce the worker's earnings. Good eyesight and ability to work at a steady and fast pace are essential for both hand- and machine-sewing jobs.

The average sewing machine operator has little opportunity for promotion beyond section forelady, although some sewing machine operators have worked their way up to production manager. Most sewers stay on the same general type of operation throughout most of their working lives. However, some workers may be moved from simpler sewing operations to more complicated tasks that pay higher piece rates.

Some tailors and dressmakers learn the trade through vocational training in day or evening schools. Graduates from vocational schools frequently are hired and given additional training on the job. Others learn the trade informally, on the job starting with relatively easy sewing operations and progressively advancing to more difficult operations. It requires several years of experience to become an all-round tailor or dressmaker.

Tailors and dressmakers may qualify for jobs as fitters or alteration tailors in department stores, clothing stores, and cleaning and dyeing shops.

Pressers usually begin as underpressers working on simple seams and garment parts. This job can be learned in a very short time. After the pressers gain experience, they work on more difficult operations and eventually may be promoted to the job of finish presser. Pressing, like tailoring, is one of the few needle trades in which workers can find similar employment in stores and in cleaning and dyeing shops. There is some transferring back and forth between pressing jobs inside and outside the apparel industry.

Employment Outlook

Employment in the apparel industry is expected to increase moderately through the 1970's. In addition to the thousands of job opportunities expected to result from employment growth, a considerable number of opportunities for young people will occur because of the tens of thousands of experienced workers who will leave the industry. About 4 out of 5 of the industry's workers are women, a large number of whom leave the industry each year to marry or to raise families. Also, this industry employs more older workers than many industries. It is estimated that deaths and retirements alone will provide 74,000 job openings annually.

Demand for apparel in the years ahead is expected to increaee rapidly. The increased demand for apparel will result mainly from increasing population and affluence. Increased emphasis on styling by the industry is also expected to be reflected in more frequent purchases of apparel. Rising per capita income during the 1970's should whet the consumer appetite for greater novelty in clothing. Furthermore, as per capita income increases people will, undoubtedly, go in for more leisure activities which should generate demand for special purpose apparel such as ski clothing.

Employment in the industry, however, is not expected to increase as rapidly as demand for apparel. Gradual increases in the use of mechanized equipment and other laborsaving devices resulting from anticipated increases in research and development expenditures are expected to result in greater output per worker. Examples of such equipment include sewing machines that can position needles and trim threads automatically; devices that automatically position fabric pieces under the needle and remove and stack completed pieces; equipment that automatically spreads fabrics on cutting tables; and the more widespread use of computers and conveyor systems for controlling and improving the movement of fabrics and apparel. The major impact of machanization is expected to be in reducing the time an operator must spend in positioning and removing work done at each stage of a production process. Most sewing, pressing, and cutting operations are expected to continue primarily as manual operations through the 1970's.

Most employment opportunities will be in sewing machine operator jobs because this occupational group is the largest and is made up mostly of women who have a high turnover rate. Designers will have many opportunities because a large proportion of this group also is composed of women. Some job openings will occur also in tailoring occupations in which a large proportion of the employees are older workers.

Several thousand job opportunities will develop for industrial and mechanical engineers, salaried managers, and skilled machine mechanics. Shortages of these workers probably will continue because of expected growth in the size of individual apparel establishments, in the number and size of companies operating more than one establishment, and in the installation of new mechanical equipment.

Openings for tailors, sample makers, and other skilled personnel in the apparel industry will continue to be found mainly in the metropolitan centers where plants manufacturing dresses, women's suits and coats, or men's and boys' suits and coats are located. There will be a small number of new jobs in men's clothing designing, patternmaking, and cutting room jobs.

Earnings and Working Conditions

In 1970, average earnings of production workers in the apparel industry were $84.37 a week or $2.39 an hour, compared with $133.73 a week or $3.36 an hour for those in all manufacturing industries. Production workers in this industry generally worked fewer hours per week than those in manufacturing as a whole. Production workers have much higher earnings in some kinds of garment factories than in others. For example, those making men's and boy's suits and coats averaged $101.85 a week in 1970, whereas those producing men's work clothing averaged $73.53 a week. Earnings of apparel workers also vary by occupation and geographical area. For example, average hourly earnings of cutters and pressers in almost all areas are higher than those of sewing machine operators; and average hourly earnings generally are lower in the South than in the Middle Atlantic States. The following tabulation gives estimated average hourly earnings for selected occupations and geographical areas in one segment of the apparel industry in April 1970.

Men's and Boys' Suits and Coats Coat Fabrication	*Estimated average hourly earnings*		
	Philadelphia	*Chicago*	*St. Louis*
All production workers	$3.06	$3.26	$2.52
Cutters, lining (men)	4.45	4.34	2.75
Pressers, finish, machine (men and women)	4.02	3.82	3.59
Finishers, hand (almost all women)	2.60	2.82	2.50
Machine sewing occupations	3.17	3.24	2.50
Sleeve setter (more women than men)	3.71	3.21	2.67
Pocket setter and tacker (more women than men)	3.38	3.07	2.52
Sleeve maker (almost all women)	3.05	3.07	2.45

Because most production workers in the apparel industry are paid on the basis of the number of pieces they produce their total earnings depend upon speed as well as skill. Sewing machine operators, hand sewers, and pressers generally are paid on a piecework basis. Cutters are paid either piecework rates or hourly wages, depending upon the practice in the area or shop in which they work. Most of the other workers, including tailors, patternmakers, graders, inspectors, and work distributors, are generally paid by the hour or week.

In most metropolitan areas, most apparel employees work in shops that have union contracts. New employees in plants which have these agreements are required to join the union after 30 days of employment. These agreements deal with such subjects as wages; hours of work; vacation and holiday pay; seniority; health, insurance, and pension plans; and other employment matters. Among the unions to which apparel workers belong are the Amalgamated Clothing Workers of America (ACWA), International Ladies' Garment Workers' Union (ILGWU), and United Garment Workers of America (UGW). The ILGWU sponsors vacation resorts for union members and their families. Both the ACWA and the ILGWU operate health centers for garment workers in major producing areas. The Amalgamated Clothing Workers of America operates child day care centers in the Baltimore, Maryland area and in Chicago and cooperative housing in New York City, Chicago, and Philadelphia. The International Ladies' Garment Workers' Union also sponsors cooperative housing in New York City.

Workers in the apparel industry can expect to lose very little work time as a result of strikes or other work stoppages because the industry has had many years of peaceful labor-management relations. However, workers making certain type of garments may have layoffs of several weeks during slack seasons. Generally, such layoffs occur more often in plants making seasonal garments, such as women's coats and suits, than in plants producing standardized garments, such as pajamas and men's shirts, which are worn all year long. In many plants, the available work during slack periods is divided so that workers can be assured of at least some earnings.

Many apparel establishments, especially those in metropolitan areas are housed in old buildings whose surroundings and facilities may frequently leave much to be desired. Newly constructed plants usually have ample space, good lighting, and air conditioning. Some of the new plants have cafeterias and health clinics with a registered nurse on duty.

Most sewing jobs are performed while sitting and are not physically strenuous. The working pace is rapid because workers' earnings depend on their production. In addition, many tasks are extremely monotonous. Serious accidents among sewers are rare, although a sewer may occasionally pierce a finger with a needle. On the other hand, pressing may be strenuous work and involves working with hot steam.

Working conditions in cutting and designing rooms are pleasant. In manufacturing establishments, designing and cutting are often performed in a separate area away from the main sewing and pressing operations. Jobs in designing and cutting operations are more interesting and less monotonous than most other apparel jobs. Moreover, since accuracy, skill, individual talent, and judgment are valued more than speed in these jobs, the work pace is less rapid.

Sources of Additional Information

Information relating to vocational and high schools that offer training in designing, tailoring, and sewing may be obtained from the Division of Vocational Education of the Department of Education in the State capital.

Information concerning apprenticeships may be obtained from the Apprenticeship Council of the State Labor Department or the local office of the U.S. Employment Service. Some local Employment Service offices give tests to determine hand-eye coordination, which is important for many apparel industry jobs.

Information may be obtained from the following sources:

Amalgamated Clothing Workers of America, 15 Union Square, New York, N.Y. 10003.

American Apparel Manufacturers Association, Inc., 2000 K St. NW., Washington, D.C. 20006.

Associated Fur Manufacturers, Inc., 101 West 30th St., New York, N.Y. 10001.

Clothing Manufacturers Association of U.S.A., 135 West 50th St., New York, N.Y. 10020.

National Outerwear and Sportswear Association, Inc., 347 Fifth Ave., New York, N.Y. 10016.

International Ladies' Garment Workers' Union, 1710 Broadway, New York, N.Y. 10019.

United Garment Workers of America, 31 Union Square, New York, N.Y. 10003.

International Association of Clothing Designers, 12 South 12th Street, Philadelphia, Pa. 19107.

National Board of the Coat and Suit Industry, 450 Seventh Ave., New York, N.Y. 10001.

National Dress Manufacturers' Association, Inc., 570 Seventh Ave., New York, N.Y. 10018.

OCCUPATIONS IN THE ATOMIC ENERGY FIELD

Atomic energy is a very compact source of enormous heat and radiation that can be used for peaceful as well as military purposes. Peaceful applications are still in the early stages of development, and continuing research and development programs will be needed during the next several decades to find new and more efficient ways of utilizing this force.

In 1970 more than 225,000 workers were employed in a variety of atomic energy activities. Large numbers were engaged in research and development work. Others were in activities such as the manufacture of nuclear weapons and other defense materials, the design and manufacture of nuclear reactors, and the production of nuclear fuels. Most atomic energy workers are scientists, engineers, technicians, or craftsmen. Employment opportunities for these workers will be favorable through the 1970's.

Applications of Atomic Energy

One of the most significant uses of atomic engery is in the production of commercial electricity, by using nuclear reactors as the heat source. (See chart 28.) Steam produced by such reactors is not generating electricity for several communities. These reactors have become competitive with systems using fossil fuels, such as coal and oil, and more than 150 nuclear facilities will be built by 1980. Dual-purpose nuclear power-desalting plants, which could provide a new source of fresh water as well as electric power, are being studied.

Nuclear reactors provide power for propulsion of submarines and surface vessels. By eliminating refueling, nuclear propulsion extends the range and mobility of our naval forces. Research towards developing nuclear propulsion for space vehicles may extend space flights beyond lunor-range.

Although existing reactors generate tremendous amounts of power from a small amount of uranium, research is continuing to develop more efficient reactors. Scientists already have produced uncontrolled fusion in the hydrogen bomb, but have not yet produced a controlled fusion reaction on a relatively small scale. Research is being conducted in the "Plowshare" program to develop peaceful uses for nuclear explosives. The program has many potential applications in areas such as gas and oil recovery, and the excavation of harbors, canals, and mountain passes.

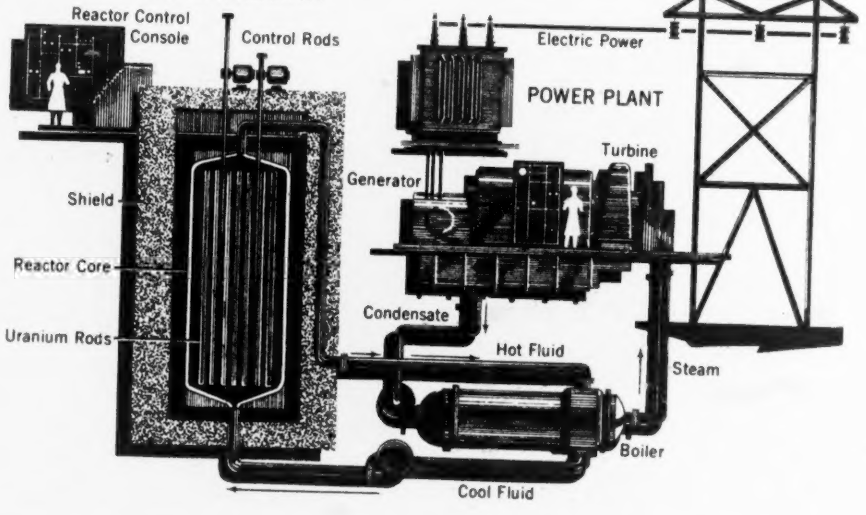
Another application is in the use of radioisotopes which decay or disintegrate spontaneously, by emitting radiation that special instruments, such as thickness gages, can detect. Radioisotopes are valuable as research tools in agriculture, medicine, and industry.

Nuclear radiation also has good potential as an aid in the preservation of food. One of the major causes of food spoilage is the activity of micro-organisms. When food is treated with radiation, these organisms are killed and the spoilage is greatly inhibited. This treatment makes possible the long term storage of certain foods without refrigeration, and extends the time for marketing perishable refrigerated items.

How Atomic Energy Is Produced

Atomic energy, or more accurately nuclear energy, may be produced through several processes, the two most important of which are fission and fusion. In fission, the nucleus of a heavy atom is split, and energy released in the form of heat and radiation produces two or more lighter elements. Fission is the splitting of the uranium or plutonium

㉘ **Nuclear reactor generating electricity**



nucleus under neutron bombardment. When neutrons emitted from this fission process bombard other nuclei, further fission takes place and, under proper conditions, results in a "chain" reaction. This reaction liberates energy which, if controlled, can be converted into useful power. In fusion, energy is released by combining the nuclei of two light atoms into a heavier atom. The detonation of atomic bombs is an application of the explosive release of enormous amounts of atomic energy. Non-weapon applications require that release of this energy be carefully controlled and regulated so that it proceeds at a manageable rate.

Controlled fission is the essential feature of a nuclear reactor. The reactor, being a furnace, requires fuel to operate. The principal source material for reactor fuel is uranium 235. Uranium in its natural state contains less than 1 percent of readily fissionable material, uranium U-235. Although natural uranium is sometimes used as reactor fuel, a more concentrated and enriched fuel can be produced and used by increasing the proportion of U-235 isotopes through a process called gaseous diffusion. U-235 undergoes fission readily, but manmade fissionable materials, such as plutonium, also can be used as reactor fuel.

The level of the chain reaction in a nuclear reactor is carefully controlled, usually by inserting special neutron-absorbing rods into the fuel chamber or "core," of the reactor. In this way, the rate of the fission reaction and of the energy produced can be regulated or stopped completely.

Thus, harnessed atomic energy is produced in a nuclear reactor in the form of heat and radiation. However, if reactors are to be used for power, the heat must be removed from the reactors and converted to electricity by conventional equipment. The major difference between nuclear and conventional thermal electric power stations is that the heat needed to generate steam to drive turbines comes from a nuclear reactor rather from a conventional steam-generating boiler fueled with coal, gas, or oil.

During the fission process, nuclear radiation is released. This radiation, identifiable only by sensitive instruments, can be ruinous to equipment and can be highly dangerous to unprotected personnel. Therefore, special materials, resistant to damage by radiation, are used in reactors and great care is taken to protect personnel.

Nature of the Atomic Energy Field

Many different kinds of research and industrial activities are required for the production and application of nuclear energy. Included in the various industrial processes are the mining, milling, and refining of uranium-bearing ores; the production of nuclear fuels; the manufacture of nuclear reactors, reactor components, and nuclear instruments; the production of special materials for use in reactors; the design, engineering, and construction of nuclear facilities; the operation and maintenance of nuclear reactors; the disposal of radioactive wastes; the processing and packaging of radioisotopes; the production of nuclear weapons; and research and development work.

These activities are performed in plants, in several different industries, as well as in laboratories and other types of facilities. Much of this work, such as ore mining and milling, manufacture of heat transfer equipment, and construction of facilities, differs little from similar nonatomic energy work. Other activities, such as manufacture of the fuels needed to run reactors, are unique to the atomic energy field.

The Federal Government supports most of the basic atomic energy activities. The U.S. Atomic Energy Commission (AEC) directs the Federal Government's atomic energy program and regulates the use of nuclear materials by private organizations. The operation of AEC-owned facilities, including laboratories, uranium processing plants, nuclear reactors, and weapons manufacturing plants, is contracted out to private organizations. More than half of all workers in atomic energy are employed in these government-owned facilities. In their own installations, private firms are engaged in many types of atomic energy activity, except development and production of military weapons and certain nuclear fuel-processing operations.

A large amount of research and development work is done in the atomic energy field. Much of this work is carried on by the AEC-owned laboratories and by university and college laboratories, other nonprofit institutions, and industrial organizations under Commission contracts.

Occupations in the Atomic Energy Field

Engineers, scientists, technicians, and craftsmen account for a higher proportion of total employment in this field than in most other fields, largely because much of the work is still in the research and development phase. Office personnel in administrative and clerical jobs represent another large group. Most of the remaining employment consists of semiskilled and unskilled workers in production work, and plant protection and other service workers.

Although many engineers in atomic energy are highly trained in nuclear technology, engineers in all other major engineering fields are employed. Mechanical engineering is the largest single engineering occupation, but large numbers of electrical and electronics, nuclear and reactor, chemical, civil, and metallurgical engineers also are employed. Many of these engineers do research and development work; others design nuclear reactors, nuclear instruments, and other equipment used in atomic energy, and in the operation of production plants.

Research laboratories and other organizations engaged in atomic energy employed a large number of scientists to perform basic and applied nuclear research. Physicists and chemists predominate, but included are many types of scientists, such as mathematicians, biological scientists, and metallurgists.

Laboratory ecologist uses a radiation detecting instrument to measure radioactivity in a live fish.

A large number of technicians assist engineers and scientists in research and development and in designing and testing equipment and materials. These workers include draftsmen; electronics, instrument, chemical, and other engineering and physical science technicians; and radiation monitors.

The atomic energy field employs many highly skilled workers to fabricate equipment to use in experimental and pilot work and to maintain the considerable amount of complex equipment and machinery. Maintenance mechanics (e.g., machinery repairmen and millwrights) and all-round machinists are employed extensively in most atomic energy activities, as are electricians, plumbers, pipefitters, and other craftsmen and chemical process operators.

Activities in the Atomic Energy Field

A brief description of some important atomic energy activities and the types of workers employed in them follows.

Uranium Exploration and Mining. The 6,500 persons employed in uranium exploration and mining in 1970 had jobs similar to those in the mining of other metallic ores. Their jobs are largely concentrated in the Colorado Plateau area of the Far West, in the States of New Mexico, Wyoming, Utah, Colorado, and Arizona. A relatively few mines account for the bulk of production and employment. Most workers in uranium mines are in production jobs, such as miner and driller in underground mines; and as truckdriver, bulldozer operator, and machine loader in open pit mines. About 1 out of 8 employees in uranium exploration and mining is in a professional job, such as mining engineer and geologist.

Uranium Ore Milling. In uranium mills, metallurgical and chemical processes are used to extract uranium from mined ore. Uranium mills, located primarily in the Colorado Plateau, employed about 1,700 workers in 1970.

These mills employ skilled machinery repairmen, millwrights, pipefitters carpenters, electricians, and chemical process operators. A small proportion of the employees in milling operations are scientists and engineers.

Uranium Refining and Enriching. Milled uranium is chemically processed to remove impurities and then converted to metal or intermediate chemical products for reactor fuel preparation. Conventional chemical and metallurgical processes are used, but they must meet more exacting standards than in most other industries. The output of refining plants may be further processed to obtain enriched uranium.

Activity in this segment of the atomic energy field is centered in Ohio, Tennessee, Kentucky, and Illinois. In 1970, uranium refining and enriching plants employed about 7,000 workers.

Maintenance craftsmen, particularly in the high automated uranium enriching plants, account for a large proportion of skilled workers. Large numbers of chemical process operators also are employed. Chemical engineers and chemists accounted for more than a third of the engineers and scientists. Many of the technicians worked in chemical analytical laboratories associated with production processes.

Plant ecologists investigate radioactivity in the soil.

Reactor Manufacturing. About 22,500 workers were employed in 1970 to design and manufacture nuclear reactors and unique reactor parts. Reactor manufacturers do extensive development work on reactors and auxiliary equipment, design the reactor, and generally fabricate some of the intricate components, such as fuel elements, control rods, and reactor cores.

More than two-fifths of the employees in firms that design and manufacture reactors are scientists, engineers, and technicians. Engineers alone represent more than one-quarter of the employment; mechanical engineers and reactor engineers, who are specialists in reactor technology, predominate. Among scientists, the largest group of workers are physicists, but many chemists, mathematicians, and metallurgists also are employed. Assisting these engineers and scientists are many draftsmen, engineering aids, and physical science technicians.

Skilled workers are employed by reactor manufacturers in experimental, production, and maintenance work. All-round machinists account for a large proportion of these craftsmen. Other craftsmen such as sheet metal workers, instrument makers, machinery repairmen, instrument repairmen, and electricians also are employed. Reactor manufacturers employ nuclear reactor operators to operate experimental and test reactors.

Reactor Operation and Maintenance. Almost 2,300 workers operated and maintained nuclear reactors producing commercial electricity in 1970. Some of the occupations found in the operation of a nuclear power station are mechanical engineer, electrical and electronics engineer, instrument technician, electronics technician, radiation monitor, reactor operator, and other power plant operators and attendants. Among the employees needed to maintain and repair reactors are machinery repairmen, instrument repairmen, electricians, and pipefitters.

Research and Development Facilities. A number of research and development laboratories and other research facilities are owned by the Atomic Energy Commission and are operated for the AEC by universities and industrial concerns. These facilities are major centers for basic and applied nuclear research in the physical, engineering, and life sciences and in the development of nuclear reactors and other nuclear equipment. In 1970, these facilities employed nearly 50,000 workers. More than half of the employees in AEC research and development facilities are engineers, scientists, and supporting technicians. Among the engineers and scientists are mechanical, electrical and electronics, chemical, reactor, and metallurgical engineers; physicists; chemists; mathematicians; metallurgists; biological scientists; and health physicists. Assisting scientists and engineers are many physical science and engineering aids; draftsmen; electronics, instrument, and biological technicians; and radiation monitors.

Administrative and clerical workers together account for a large proportion of employment. The skilled worker group includes large numbers of all-round machinists, electricians, machinery repairmen, and millwrights, as well as substantial numbers of tool and die makers, instrument makers, and pipefitters. Nuclear reactor operators are employed to operate research and test reactors and many service workers are employed in plant protection and security operations.

Although most nuclear energy research is performed in AEC research and development facilities, additional research is performed in the privately owned research laboratories of educational institutions, other nonprofit institutions, and industrial concerns. Like the AEC facilities, these laboratories employ a large proportion of workers in scientific, engineering, and other technical jobs.

Production of Nuclear Weapons and Other Defense Materials. More than 31,000 workers were employed in 1970 in establishments producing nuclear weapons and weapon components, plutonium, and other defense materials. The skilled workers in this industry include large numbers of machinery repairmen and millwrights, chemical process operators, all-round machinists, electricians, instrument repairmen, pipefitters, tool and die makers, and instrument makers.

Among the large number of scientists and engineers employed at these facilities are many chemists, physicists, and mechanical, chemical, and electrical and electronics engineers. Many engineering and physical science aids, draftsmen, radiation monitors, and electronics technicians, are employed to assist scientists and engineers.

Other Atomic Energy Activities. Nearly 1,700 workers were employed in 1970 to produce special materials such as beryllium, zirconium, and hafnium for use in reactors.

More than 6,500 workers were employed by companies that manufacture reactor control instruments, radiation detection and monitoring devices, and other instruments for the atomic energy field. Production of these instruments involves work similar to that in instrument manufacturing in general. Engineers and technicians represent a substantial proportion of employment in this field.

More than 700 persons were employed in companies which specialize in the manufacture of particle accelerators or their specialized components. These machines enable scientists to study the structure and properties of the elementary particles that make up the nucleus of an atom. Workers employed in the design and manufacture of these machines include electrical and electronics engineers, mechanical engineers, physicists, draftsmen, electronics technicians, and machinists.

Other workers in the atomic energy field are engaged in activities such as processing and packaging radioisotopes, manufacturing radiography units and radiation gages, packaging and disposing of radioactive wastes, and industrial radiography.

Government Employment. The

Atomic Energy Commission, which directs the Federal Government's atomic energy program, employed more than 7,300 workers in its headquarters and field offices in 1970. Over 1,800 engineers and scientists were employed by the Commission, including personnel in nearly every major engineering and scientific occupation. Since the AEC is primarily an administrative and regulatory agency, nearly 9 out of 10 Commission employees are in administrative and other professional positions or in clerical jobs. This proportion of administrative and clerical personnel is much larger than among other employers in the atomic energy field.

In addition to those employed by the Atomic Energy Commission, several thousand government employees are engaged in atomic energy work in other Federal agencies and in regulatory and promotional activities of State and local governments. Their responsibilities involve atomic energy research and application, and establishment of radiation health and safety measures.

Unique Atomic Energy Occupations. Most of the occupations discussed in the preceding sections are similar to those found in other industrial activities, although they may have job titles unique to the atomic energy field (such as nuclear engineer, radiation chemist, and nuclear reactor operator) and require some specialized knowledge of atomic energy. A detailed discussion of the duties, training, and employment outlook for most of these occupations appears elsewhere in the *Handbook*.

The health physics occupations, which are unique to the atomic energy field, and some other occupations that are unique in that they require training in the handling and use of radioactive materials or radiation-producing equipment, are discussed briefly in the following sections.

Health physicists (sometimes called radiation or radiological physicists or chemists) are responsible for detecting radiation and applying safety standards to control exposure to it. In 1970, nearly 1,100 health physicists were employed in radiation protection work, research, or teaching.

Health physicists are responsible for planning and organizing radiological health programs at atomic energy facilities. They establish standards of inspection and determine procedures for protecting employees and eliminating radiological hazards. They supervise the inspection of work areas with potential radiation hazards and prepare instructions covering safe work procedures in these areas.

Health physicists also plan and supervise training programs dealing with radiation hazards and advise others on methods of dealing with such hazards. In some cases, they are employed on research projects dealing with the effects of human exposure to radiation and may develop procedures to be followed in using radioactive materials.

Radiation monitors (also called health-physics technicians) generally work under the supervision of health physicists. An estimated 1,600 radiation monitors were employed in the atomic energy field in 1970. They use special instruments to monitor work areas and equipment to detect radioactive contamination. Soil, water, and air samples are taken frequently to determine radiation levels. Monitors may also collect and analyze radiation detectors worn by workers, such as film badges and pocket detection chambers.

Radiation monitors inform their supervisors when a worker's exposure to radiation or the level of radiation in a work area approaches specified maximum permissible limits and they recommend work stoppage in potentially unsafe areas. They calculate the amount of time that personnel may work in contaminated areas, considering maximum

Health physics technician determines radiation level of sample.

radiation exposure limits and the radiation level in the area. Monitors also may give instructions in radiation safety procedures and prescribe special clothing requirements and other safety precautions for workers entering radiation zones.

Nuclear reactor operators perform work in nuclear power stations similar to that of boiler operators in conventional power stations; however, the controls operated are different. In addition, reactor operators may assist in the loading and unloading of reactor cores. Nuclear reactor operators who work with research and test reactors check reactor control panels and adjust controls to maintain specified operating conditions within the reactor, such as power and radiation levels. Nearly 1,200 persons were employed as nuclear reactor operators in 1970.

Accelerator operators set up and coordinate the operation of particle accelerators. They adjust machine controls to accelerate electrically charged particles, in accordance with instructions from the scientist in charge of the experiment, and set up target materials which are to be bombarded by the accelerated particles. They also may assist in the maintenance of equipment.

Radiographers take radiographs of metal castings, welds, and other objects by adjusting the controls of an X-ray machine or by exposing a source of radioactivity to the object to be radiographed. They select the proper type of radiation source and film to use and apply standard mathematical formulas to determine exposure distance and time. While taking radiographs, they use radiation detection instruments to monitor the work area for potential radiation hazards. Radiographers also may remove and develop the film or plate and assist in its analysis.

Hot-cell technicians operate remote-controlled equipment to test radioactive materials that are placed in hot cells—rooms that are enclosed with radiation shielding materials, such as lead and concrete. By controlling "slave manipulators" (mechanical devices that act as a pair of arms and hands) from outside the cell and observing their actions through the cell window, these technicians perform standard chemical and metallurgical operations with radioactive materials. Hot-cell technicians also may enter the cell wearing protective clothing to set up experiments or to decontaminate the cell and equipment. *Decontamination men* have the primary duty of decontaminating equipment, plant areas, and materials exposed to radioactive contaminants. They use radiation-detection instruments to locate the contamination; eliminate it by the use of special equipment, detergents, and chemicals; and then verify the effectiveness of the decontamination measures. *Waste-treatment operators* operate heat exchange units, pumps, compressors, and other equipment to decontaminate and dispose of radioactive waste liquids. *Waste-disposal men* seal contaminated wastes in concrete containers and transport the containers to a burial ground.

Radioisotope-production operators use remote control manipulators and other equipment to prepare radioisotopes for shipping and to perform chemical analyses to ensure that radioisotopes conform to specifications.

Training and Other Qualifications

Training and educational requirements and advancement opportunities for most workers in atomic energy activities are generally similar to those for comparable jobs in other fields and are discussed elsewhere in the *Handbook* under the specific occupation. However, specialized training is required for many workers because the atomic energy field is relatively new, requires rigorous work standards in both its research and production activities, and has unique health and safety problems.

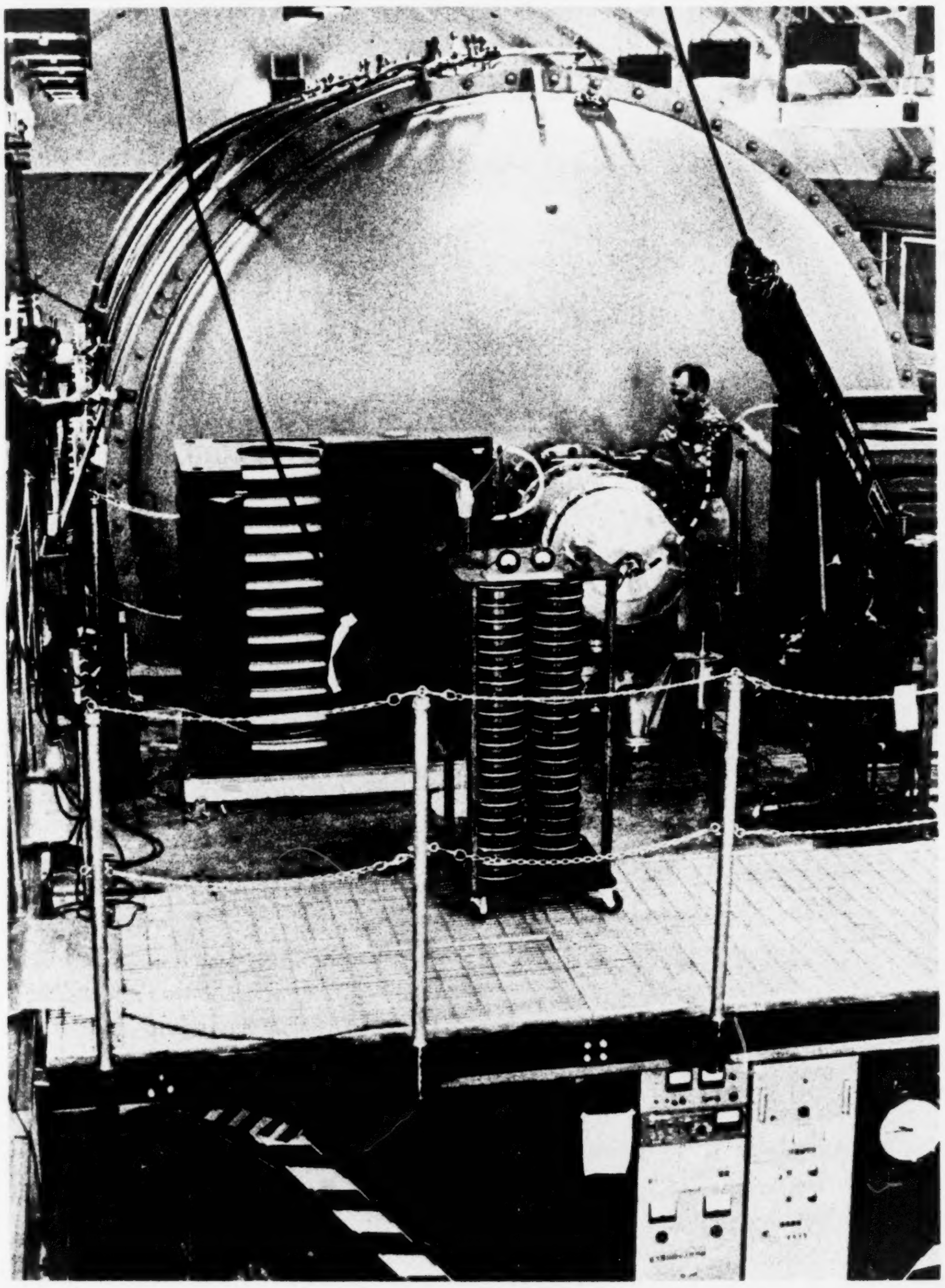
Engineers and scientists at all levels of professional training are employed in the atomic energy field. Many of them have had advanced training, particularly those engaged in research, development, and design work. Of the scientists and engineers employed in research and development by major AEC contractors, about one-fourth have a Ph. D. degree. The proportion of engineers with Ph. D. degrees is smaller than the proportion of scientists with such degrees. However, graduate training is also preferred for an increasing number of engineering jobs. Training in nuclear engineering, although increasing at the under graduate level, is predominately at the graduate level.

Specialized knowledge of nuclear energy, which is essential for most scientific and engineering positions in atomic energy, may be obtained at a university or sometimes on-the-job.

Colleges and universities have expanded their facilities and curriculums to provide training in nuclear energy. Engineers and scientists who plan to specialize in the atomic energy field generally take graduate work in nuclear energy, although introductory or background courses may be taken at the undergraduate level. Some colleges and universities award graduate degrees in nuclear engineering or nuclear science. Others offer graduate training in these fields, but award degrees only in the traditional engineering or scientific fields.

Craftsmen in some atomic energy jobs need more training than most craftsmen in comparable nonatomic jobs. High skill requirements are often needed because of the extreme precision required to insure efficient operation and maintenance of complex equipment and machinery. For example, pipefitters may have to fit pipe to tolerances of less than one ten-thousandth of an inch and work with pipe made from rare costly metals. Welding also may have to meet higher reliability standards than in most nonatomic fields. Craftsmen in atomic energy generally obtain the required special skills on the job. Many AEC installations also have apprentice training programs to develop craft skills.

Health physicists should have at least a bachelor's degree in physics, chemistry, or engineering, and a year or more of graduate work in health physics. A Ph. D. degree often is required for teaching and research.



Scientists test electron accelerator.

A radiation monitor can qualify for on-the-job training with a high school education with courses in mathematics, physics, and chemistry. Radiation monitors must become familiar with characteristics of radiation, maximum permissible radiation exposure levels, and methods of calculating exposure periods. They also must learn how to calibrate the instruments they use.

Nuclear power reactor operators need a basic understanding of reactor theory and a working knowledge of reactor controls. Most operator trainees have a high school education. Trainees usually are selected from conventional power plant personnel having experience as operators of boiler, turbine, or electrical machinery. Preference sometimes is given to those who have completed courses in science and engineering at the college level. Workers who operate the controls of private nuclear reactors must be licensed by the AEC. To qualify for a license, the trainee must pass an operating test, a written test given by the AEC, and a medical examination.

An accelerator operator usually requires a high school education that includes courses in mathematics and physics to qualify for on-the-job training. Accelerator operators receive several months of on-the-job training covering operating, repair, and safety procedures. To qualify for on-the-job training as a radiographer, a high school education, including courses in mathematics, chemistry, and physics, usually is sufficient.

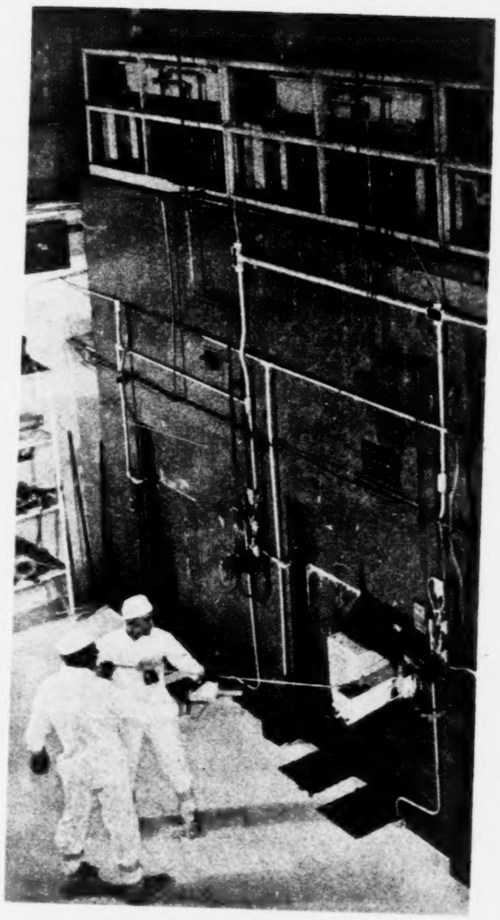
Hot-cell technicians and decontamination men may be high school graduates with some mechanical experience who can qualify for on-the-job training. They may be given in-plant training lasting several months. Radioisotope-production operators usually require a high school education with courses in chemistry. High school graduates can qualify as waste-treatment operators, but experience in reading electronic instruments or in a chemical laboratory is desirable. High school graduates also can qualify for employment as waste-disposal men. They receive on-the-job training in the operation of equipment and the avoidance of radiation hazards.

Other workers in the atomic energy field also need special training because of the presence of potential radiation hazards. Employees who work in the vicinity of such hazards are always given on-the-job training in the nature of radiation and the procedures to follow in case of its accidental release.

Individuals who handle classified data (restricted for reasons of national security) or who work on classified projects in the atomic energy field must have a security clearance, based on an investigation of a person's character, loyalty, and associations.

The Atomic Energy Commission, at its contractor-operated facilities, supports on-the-job and specialized training programs to help prepare scientists, engineers, technicians, and other workers for the atomic energy field. The AEC also offers graduate fellowships in specialized nuclear fields.

More than 600 fellowships were awarded for the 1969–70 academic year. In addition, other Federal agencies also gave a number of fellowships for graduate work in nuclear science and technology. The prerequisite for consideration for a fellowship is a bachelor's degree in engineering or physical science.



Technicians check reactor using remote-control manipulators.

Additional educational and training opportunities are offered in cooperative programs arranged by AEC laboratories with colleges and universities. Temporary employment at AEC-owned laboratories is available to faculty members and students. Undergraduates and graduate engineering students may work at laboratories and other Commission facilities on a rotation basis with classroom studies, and many graduate students do their thesis work at AEC laboratories.

Many Commission contractors provide employees with training at their own plants or at nearby colleges and universities.

Employment Outlook

Total employment in the atomic energy field is expected to increase moderately during the 1970's as commercial activities in atomic energy expand, and as new applications of this energy form are developed.

Many factors point to a long-term expansion in this field. Expenditures for atomic energy research and development should lead to further employment growth in production activities; the use of nuclear reactors in electric power generating stations is becoming increasingly widespread; and the use of reactors in conjunction with power generation to desalt sea water also is expected to increase. Growth in the use of nuclear reactors for propulsion of surface ships is anticipated, although progress in this area may not be as rapid as in electric power generation. Expansion also is expected in the "Plowshare" program to develop peaceful uses for nuclear explosives, in programs to further develop radioisotope technology, and in the use of nuclear power in space.

Employment opportunities are expected to rise significantly for workers who design and manufacture nuclear power reactors and instruments, and who process and package radioisotopes. As more nuclear reactors are built and put into operation, employment will further increase both in the operation and maintenance of reactors, and in related activities such as the fabrication and reprocessing of reactor fuel elements and the disposal of radioactive wastes. Employment in mining, milling, refining, and enrichment of uranium will increase as the demand for nuclear fuel increases. As the use of nuclear power becomes more widespread, there also will be an increase in employment of regulatory workers in both the Atomic Energy Commission and in State agencies to insure safe use of atomic energy. Expansion in these areas of atomic energy will create very good employment opportunities for trained professional and technical workers and for skilled craftsmen.

In addition to the employment opportunities created by expansion in atomic energy activities, other job openings will occur because of the need to replace workers who retire, die, or transfer to other industries.

Earnings and Working Conditions

In 1970, blue-collar workers employed by contractors at AEC laboratories and other installations had average straight-time hourly earnings of $4.11; blue-collar workers in all manufacturing industries had average earnings of $3.36 an hour.

Professional workers employed at AEC installations averaged $15,000 a year in base pay in 1970, and other white-collar workers (largely clerical and other office personnel) averaged nearly $7,300 a year. (Earnings data for many of the occupations found in the atomic energy field are included in the statements on these occupations elsewhere in the *Handbook*.)

Working conditions in uranium mining and milling, instrument and auxiliary equipment manufacturing, and facilities construction are generally similar to those in comparable nonatomic energy activities, except for radiation safety precautions. All uranium mines are equipped with mechanical ventilation systems that reduce the concentration of radioactive radon gas—a substance that can cause lung injury if inhaled over a number of years. Efforts to eliminate this hazard are continuing. In the other atomic energy activities in which the major proportion of workers in the field are employed, working conditions generally are very good. Buildings and plants are well lighted and ventilated. Equipment, tools, and machines are modern and sometimes the most advanced of their type. Only a small proportion of employees in the atomic energy field actually work in areas where direct radiation hazard dangers exist. Even in these areas, shielding, automatic alarm systems, and other devices and clothing given ample protection to the workers. In some cases, plants are located in remote areas.

Extensive safeguards and operating practices ensure the health and safety of workers, and the AEC and its contractors have maintained an excellent safety record. The AEC regulates the possession and use of radioactive materials, and AEC personnel inspect nuclear facilities to insure compliance with the AEC's health and safety requirements. Constant efforts are being made to provide better safety standards and regulations.

Most plant hourly paid workers belong to unions that represent their particular craft or industry.

Sources of Additional Information

Additional information about the atomic energy field may be obtained from:

U.S. Atomic Energy Commission,
Washington, D.C. 20545.

OCCUPATION IN THE BAKING INDUSTRY

The baking industry is one of the largest food-processing employers in the United States. Occupations in bakeries provide steady, year-round employment for thousands of workers throughout the country.

The industry provides jobs to suit a variety of interests, skills, and talents. Workers make, wrap, and pack bakery products and deliver them to stores, homes, and restaurants. Mechanics maintain and repair the machinery used in modern bakeries and service delivery trucks. Managers and sales specialists direct operations and clerical workers do the regular office duties.

Nature and Location of the Industry

In 1970, the baking industry employed 282,000 workers in about 4,500 bakeries. About 85 percent of these workers were employed in bakeries that produced perishable goods such as bread, rolls, pies, cakes, and doughnuts. The remaining workers were employed in bakeries that produced "dry" goods such as cookies, crackers, pretzels, and ice cream cones. Included in this industry are large wholesale bakeries that sell to retail stores, restaurants, hotels, and other large customers; home service bakeries that deliver their products directly to the customers' homes; bakeries owned and operated by grocery chains; and the central baking plants of companies operating several retail bake shops.

In addition to the bakeries described above, over 19,000 single-shop retail bakeries employed about 100,000 men and women including shop owners. Although some retail bakeshops employed 20 individuals or more, the average shop employed about 5 or 6. Many baking operations are done by hand rather than machine, and therefore, retail bakeries offer many opportunities not available in large bakeries to the skilled baking craftsman.

Most bakeries producing perishable goods are relatively small because they serve only their local area. However, an increasing number serve markets up to 200 miles away, and a few serve even wider areas. In contrast, bakeries that produce dry baked goods generally are large plants and distribute their products regionally or nationally. These bakeries employed an average of 120 workers compared with about 50 in bakeries producing perishable products.

Almost every community in the United States has at least one bakery. However, more than half of all industrial bakery employees are in New York, Pennsylvania, California, Ohio, Illinois, New Jersey, Texas, and Massachusetts.

Nearly 60 percent of the industry's employees are production workers. They do the actual baking, handle raw materials, maintain equipment, wrap and pack the products, and keep the bakeries sanitary. Another 20 percent of the employees deliver the industry's products. Most of these employees work as driver-salesmen, selling to retail stores or directly to customers in their homes. Other drivers with no sales duties deliver bakery products to distribution centers, hotels, restaurants, and stores. The remaining 20 percent of the work force are employed in administrative, professional, technical, and clerical jobs.

Approximately 1 out of 5 industrial bakery workers are women, most of whom are office workers such as secretaries or bookkeepers. Some are employed in production jobs, such as slicing machine operator, wrapping machine operator, or pie and cake packer, but very few women are bakers.

Production Occupations. The principal baking processes consist of blending, sifting, mixing, proofing, baking, and wrapping and packing. Since bread is the primary product of the industry, the following descriptions of occupations relate principally to the production of bread. With some variations, depending on the product and the amount of mechanization, these are the occupations in any industrial bakery.

In general, production workers load and unload machines, watch the operation of the machines, and inspect the output. *Mixers* (D.O.T. 520.885) weigh ingredients and combine them in blending machines. By means of instruments, they carefully control timing and temperature in order to produce a uniform, well-blended dough. The dough is sent to a "proofing" room where the warm temperature produces a fermenting process which causes the dough to rise. When the dough has risen, it is poured into another blending machine, and additional flour, liquids, sugar, salt, and shortening are added and mixed. The dough then goes through another fermenting process before it is shaped into loaves or rolls. *Dividermen* (D.O.T. 526.782) operate machines which divide the dough according to the weight of the loaf to be produced. The pieces of dough are rolled into balls which are dusted with flour in a rounding machine *Dough molders* or *molding machine operators* (D.O.T.

520.885) operate machines which press all the air bubbles from the dough and form it into loaves or rolls. "Continuous mixing," an automatic process that is being used increasingly, eliminates many of the steps described above. When fancy shaped bread or rolls are made, *bench hands* (D.O.T. 520.884) knead and form the dough by hand into various shapes and place the pieces of dough in the pans. The pans containing the machine and hand-shaped dough go to the final proofing room where the dough rises for about an hour before it is removed and placed in the oven.

Ovenmen (D.O.T. 526.885) adjust temperature and timing devices on the ovens.

In small bakeries, *all-round bakers* (D.O.T. 526.781), assisted by helpers, usually do all the steps needed to turn out finished baked products. In large bakeries, all-round bakers are employed as working foremen. They supervise the men and machines in their department and coordinate their activity with that in other departments in order to meet production schedules.

A considerable number of *helpers* (D.O.T. 526.886) are employed in baking operations. They may assist all-round bakers and specialized bakery workers. They have job titles such as dough mixer helper, bench hand helper, and ovenman helper. Helpers also perform such jobs as greasing pans, removing bread from pans, pushing troughs and racks, and washing pans.

After baked foods leave the oven and are cooled, several types of workers prepare them for delivery to customers. *Slicing-and-wrapping machine operators* (D.O.T. 521.885) feed loaves of bread onto conveyors leading into the machines, watch the slicing and wrapping operations, adjust the machines, and keep them supplied with plastic bags, paper, and labels. A conveyor then takes the wrapped loaves to the shipping platform.

Many bakery employees work in icing departments where they give the finishing touches to cakes, pastries, and other sweet goods. *Icing mixers* (D.O.T. 520.885) prepare cake icings and fillings, following special formulas of the bakery. They weigh and measure ingredients and mix them by machine. They also prepare cooked fillings for pies, tarts, and other pastries.

In small plants, icing mixers may also spread icing on cakes and cookies. *Hand icers* (D.O.T. 524.884) are skilled craftsmen who decorate special products such as wedding cakes, birthday cakes, and fancy pastries. When the product is uniform or requires no special decoration, the frosting may be applied by *machine icers* (D.O.T. 524.885).

Bakeries also employ many workers in their storage, warehousing, and shipping departments. Receiving and stock clerks check and keep records of incoming supplies and ingredients, and deliver them to various departments. Packers and checkers make up orders of bakery products for delivery by driver-salesmen.

Maintenance Occupations. Baking firms employ skilled maintenance workers such as machinists, electricians, and stationary engineers and their helpers to keep machinery and equipment in good condition. Large plants, which are usually highly mechanized, employ many of these workers. In addition, since many baking firms have fleets of trucks, many truck mechanics are employed for maintenance.

Sales and Driving Occupations. The selling and delivery of finished baked foods to grocers, restaurants, hotels, homes, and other customers provide jobs for many thousands of workers. Some of these workers sell baked goods, some drive trucks, and many do both.

Driver-salesmen, also called routemen (D.O.T. 292.358), work for either wholesale bakeries or home-service bakeries. They deliver baked foods to grocery stores or to homes along their routes and collect payment for delivered products. A major part of their job is to increase customers' orders and gain new customers. Wholesale driver-salesmen arrange their baked products on shelves or display racks in grocery stores and may restock shelves several times a day in busy stores. Home-service driver-salesmen make deliveries directly to customers' homes. At the end of each day, driver-salesmen return unsold baked goods to the bakery, report the day's transactions, and turn in money collected. They also make a list of the items that they think grocers or housewives will buy the next day. These estimates guide production managers in making up production schedules for the next morning.

A large bakery may employ several route supervisors, each in charge of 6 to 10 driver-salesmen. In a smaller bakery, one route supervisor may be in charge of all salesmen. In addition to training new driver-salesmen, route supervisors may serve as temporary replacements for absent salesmen.

Chain grocery store bakeries and multioutlet retail bakeries employ truckdrivers rather than driver-salesmen to drive large vans, and deliver baked foods to each of their company's stores. Stock clerks or sales clerks then arrange the display of baked goods in the stores.

Administrative, Clerical, and Professional and Technical Occupations. Administrators in large baking firms and proprietors of small firms coordinate all baking activities from the purchase of raw materials to the production and delivery of baked products. In large baking firms, activities are divided into separate departments or functions and supervised by plant managers, comptrollers, sales managers, and other executives. Some administrative employees specialize in accounting, purchasing, advertising, personnel and industrial relations, or other fields. Bakeries employ many types of clerical workers, including bookkeepers, cashiers, clerks, business machine operators, typists, and switchboard operators. A large proportion of these office workers are women. Some large baking companies have laboratories and test kitchens where chemists, home economists, and their assistants test ingredients and prepare formulas and recipes for bread and other baked items. (Detailed discussions of the duties, training, and employment outlook for maintenance, sales, driving, administrative, clerical, and technical personnel appear elsewhere in the *Handbook.*)

Training, Other Qualifications, and Advancement

Training requirements for occupations in the baking industry range from a few days on the job to several years. For example, some bakery workers, such as slicing machine operators, can be trained in a few days. Skilled workers, such as all-round bakers and baking specialists, require at least 3 or 4 years of training. Professional personnel and some administrative workers must have a college degree or equivalent experience in their particular specialty.

Most inexperienced production workers in the baking industry are hired as helpers (utility workers). They may be assigned such tasks as carrying ingredients to mixing machines, or pushing troughs of dough to the proofing room. By working alongside bakers, helpers are able to acquire baking skills.

Some bakers learn their trade through formal apprenticeship programs. Generally, apprentices are selected from among the helpers. Employers usually require that apprentice applicants be between 18 and 26 years of age and have a high school or vocational school education. Apprenticeship programs last 3 or 4 years and include on-the-job training in all baking operations and classroom instruction in related subjects.

Training programs for unemployed and underemployed workers seeking entry jobs as bakers or cake decorators are in operation in several cities under provisions of the Manpower Development and Training Act.

Some workers take courses in vocational school or learn the trade in the Armed Forces. Such training may not qualify a young man as a skilled baker, but it may help him to become an apprentice and perhaps shorten his apprenticeship.

Bakers may be promoted to jobs such as working or department foreman. Some bakers who have developed special skill in fancy cakemaking or piemaking may find jobs in hotel or restaurant bakeries. All-round bakers with some business ability sometimes open their own bakeshops.

Employees of the baking industry must be in good health because most States require a health certificate indicating that the worker is free from communicable diseases. Good health is also important because of the irregular working hours and extremes in temperature found in bakeries.

Some bakeries have apprenticeship programs for maintenance jobs such as machinists, electricians, and mechanics. Other plants hire inexperienced workers as mechanics' helpers, who gain experience and know-how while working with skilled mechanics. Some bakeries hire only skilled maintenance men.

For jobs as driver-salesmen or truckdrivers, baking firms generally hire inexperienced young men with a high school education. These workers often begin as stock clerks, packers, or checkers, and may be promoted to driving jobs as vacancies occur. Applicants must be able to get a chauffeur's license and are sometimes tested by the baking companies to determine whether or not they are safe drivers. A new worker who wishes to sell as well as drive should have a pleasant appearance and the ability to get along well with people. Classroom instruction in sales, display, and delivery procedures is sometimes given to new driver-salesmen, but most training is given on the job by route supervisors. Driver-salesmen may be promoted to route supervisor and sales manager.

Administrative jobs are usually filled by upgrading personnel already employed in the firm. Some owners and production managers of bakeries have come from the ranks of baking craftsmen and some begin their careers in sales occupations. In recent years, large baking firms have required their new administrative workers to have a college degree in one of the administrative fields, such as marketing, accounting, labor relations, personnel, or advertising. Kansas State University at Manhattan offers a bachelor of science degree in baking science and management. The American Institute of Baking conducts a school of baking for persons with a bachelor's degree who wish to qualify for managerial positions in the industry.

Young persons who have completed a commercial course in high school, junior college, or a business school usually are preferred for the secretarial, stenographic, and other office jobs.

Employment Outlook

Employment in the baking industry is expected to decline slowly through the 1970's. Nevertheless, several thousand job openings are anticipated each year because of the need to replace workers who retire, die, or transfer to other fields of work.

The demand for bakery products is expected to rise moderately during this period in response to increases in population. However, because of increasing efficiency in production, total employment is expected to decline. Even so, employment in some occupations is expected to increase. For example, more truckdrivers will be needed as suburban developments increase and sales territories expand. Additional maintenance workers will be needed to keep machinery and other equipment in operating order as bakeries become more mechanized. Some increase may occur in the number of clerical workers as a result of additional recordkeeping requirements. However, the anticipated increases in these occupations will be more than offset by the continuing decline in the number of production workers resulting from the installation of mechanized processing and materials handling equipment, and improvements in the methods of processing baked goods. Pneumatic conveyors, for example, greatly increase efficiency in materials handling operations, and the "continuous mix" process eliminates dough mixing and proofing operations. In addition, the freezing of baked goods for storage until ready for sale permits bakeries to prepare a week's requirements at one time rather than small batches daily.

Earnings and Working Conditions

Earnings of production workers in the perishable bakery products industry averaged $128.18 a week, or $3.27 an hour, in 1970. The rates were slightly lower in biscuit and cracker bakeries. Wage rates tend to be higher in the West and North than in the South or Southwest.

According to union-management contracts covering employees in 24 wholesale bakeries producing bread and related products, minimum hourly rates in major occupations in 1970 ranged as follows:

Baking foremen and all-round bakers	$3.55–5.03
Molders and dividers and molding and dividing machine operators	3.16–4.72
Mixers (dough or icing)	3.01–4.72
Ovenmen	3.01–4.72
Benchmen	3.01–4.63
Wrapping machine operators	2.83–3.86
Utilitymen (general helpers)	2.66–4.12
Porters and cleaners	2.66–4.12

Some plant employees work night shifts and weekends because baking is done around the clock in many plants. Workers receive extra pay for night-work. However, the night shift is being eliminated in some bakeries because the increasing use of freezing processes makes it possible to prepare baked goods in advance and store them until needed. Most plant workers are on a 40-hour workweek, although some work 35 or 37½ hours and others 44 or 48 hours regularly. For those who work a 35- or 37½-hour week, time and a half is paid for work beyond their regular schedule. For all others, time and a half is paid for all work over 40 hours.

Driver-salesmen usually receive a guaranteed minimum salary plus a percentage of their sales. According to limited information from union-management contracts in effect in 1970, driver-salesmen for both wholesale and home-service bakeries had minimum weekly salaries of from $87 to $175. By selling more baked products to more customers, driver-salesmen can increase their earnings. Companies generally pay for uniforms and their maintenance.

Truckdrivers for baking plants are paid by the hour. Hourly rates and hours worked vary from city to city. In 1970, the minimum wage rates and maximum hours a week before overtime rates prevail, provided by union-management contracts for truckdrivers of bakeries producing bread, cakes, pies, etc. in 10 selected cities were as follows:

	Minimum wage rate	*Hours per week*
Atlanta, Ga.	$3.25	40
Cleveland, Ohio	3.89	40
Dallas, Tex.	3.25	40
Detroit, Mich. (bread)	3.74	40
Houston, Tex.	3.25	40
Little Rock, Ark.	3.15	45
New York, N.Y. (cake and pastry)	4.18	40
Oklahoma City, Okla.	3.35	40
Pittsburgh, Pa. (bread)	3.29	44
Oakland, Calif. (transport)	4.63	40

Working conditions in bakeries are generally good. However, many jobs involve some strenuous physical work, despite the considerable mechanization of baking processes. Work near ovens can be hot, especially in the summer.

Paid vacations for employees are almost universal in industrial baking firms. Vacation periods range from 1 to 4 weeks, according to length of service. Paid holidays range from 5 to 11 days, depending on the locality. Most baking firms have adopted some type of insurance or pension arrangement for their employees, such as life insurance, health insurance programs, or retirement pension plans. A large number of employees are covered by joint union-industry health and welfare plans, and pension systems which are paid for entirely by employer contributions.

Most plant workers and drivers belong to a labor union. Bakers, baking specialists, and other plant workers have been organized by the Bakery and Confectionery Workers' International Union of America. Driver-salesmen and transport drivers are generally members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Some maintenance men are members of craft unions such as the International Association of Machinists and Aerospace Workers and the International Union of Operating Engineers.

Sources of Additional Information

Information on local job openings may be obtained directly from bakeries in the community, local offices of the State employment service, or locals of the labor unions noted previously.

General information on job opportunities in the baking industry and on requirements for entering accredited schools which offer courses or degrees in baking science and technology may be obtained by writing to:

American Bakers Association, 1700 Pennsylvania Ave. NW., Washington, D.C. 20006.

OCCUPATIONS IN THE DRUG INDUSTRY

Potions and spells for the cure and prevention of pain and disease are legion in medical folklore. But twentieth-century science has created a supply of drugs undreamed of by even the most imaginative apothecaries of the past.

More than 10,000 prescription drugs alone are available to today's physician. These drugs have resulted in the control of cardiovascular disease, malaria, pneumonia, and even some forms of cancer. Hormones have relieved the pain and crippling effects of arthritis and other diseases. Tranquilizers and other drugs have done much to reduce the afflictions of mental illness. Vaccines have reduced dramatically the toll of polio, whooping cough, and measles.

The American drug industry has risen to a position of world-wide prominence in the research and development of new drugs. The drug industry spends a higher proportion of its funds for research than any other American industry. A large pharmaceutical firm in the United States may test 2,000 or more substances a year and spend millions of dollars to develop one new drug.

Although the drug industry looks to its many scientific and technical personnel to carry out its vast research programs, three out of every five jobs in the industry do not require that the worker have more than a high school education.

Nature and Location of the Industry

In 1970, an estimated 150,000 workers were employed in the drug industry. About 115,000 of these worked in plants that made pharmaceutical preparations (finished drugs), such as antibiotics and aspirin. Another 20,000 were employed in plants that produced bulk medicinal chemicals and botanicals used in making finished drugs; and nearly 15,000 worked in plants that made biological products, such as serums and vaccines.

Drug plants typically employ large numbers of workers. About two-thirds of the industry's employees were in plants having more than 500 workers. Some of the largest plants employed more than 5,000.

About three-fourths of the industry's workers were employed in six States: New Jersey, New York, Indiana, Pennsylvania, Illinois, and Michigan. Large plants are located in Indianapolis, Ind.; Chicago, Ill.; Nutley and Rahway, N.J.; Philadelphia, Pa.; Detroit and Kalamazoo, Mich.; and Pearl River, N.Y.

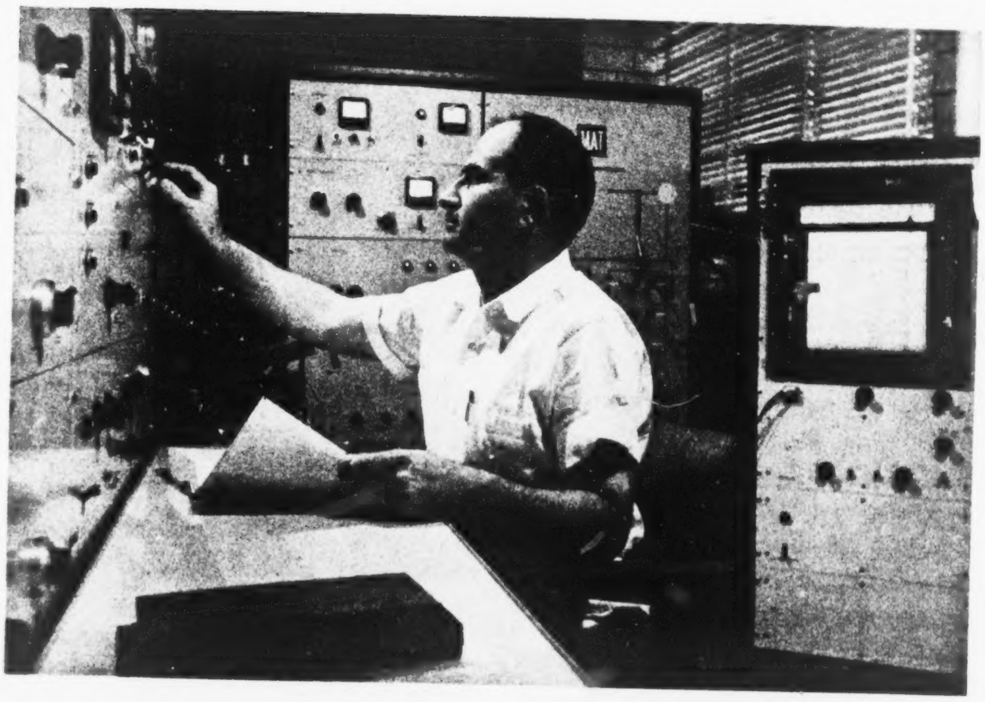
One of the most striking characteristics of the drug industry is the large volume of new products developed in its research laboratories. Examples of important new drugs reaching the market during the last decade are: vaccine for the prevention of German measles; oral vaccine for the prevention of polio; and oral agents for the control of diabetes. Because of the strong emphasis on the discovery of new products, the drug industry has a larger proportion of its employees in research and development activities than most other industries.

A primary research method for testing new drugs is a procedure called screening. For example, an antibiotic sample may be placed in a virus culture. If the antibiotic affects the culture, it is next tested on laboratory animals that have been infected with the same virus. Promising compounds are studies further for evidence of useful—and harmful—effects. A new drug will be selected for testing in man only if it promises to have therapeutic advantages over comparable drugs already in use, or if it offers the possibility of being safer than those already in use.

After screening, a clinical investigation, or trial of the drug in human patients, is made. Supplies of the drug are given to a small circle of doctors, called clinical investigators, who administer it to carefully selected patients. The patients are observed closely and special studies are made to determine the drug's effect. If a drug proves useful, arrangements are made for additional tests with a larger group of physicians, including some in private practice.

Once a drug has successfully passed animal and clinical tests and has been approved by the Food and Drug Administration, problems of production methods and costs must be worked out before the actual manufacturing process begins. If the process originally used in the research laboratory to prepare and compound the ingredients is complicated and expensive, pharmacists, chemists, packaging engineers, and production specialists are then assigned to develop improved processes that can be economically adapted to mass production techniques.

Drug manufacturing plants have developed a high degree of automation in many production operations. Milling and micronizing machines (which pulverize substances into extremely fine particles) are used to reduce bulk chemicals to the required size. These finished chemicals are combined and processed further in mixing machines. The mixed ingredients may then be mechanically capsulized, pressed into tablets, or bottled. One type of machine, for example, automatically fills, seals, and stamps capsules. Other machines fill bottles with capsules, tablets, or liquids, and seal, label, and package the bottles. Drug products are inspected at various stages during the manufacturing process to assure that they conform to specifications. Although some inspection operations are mechanized, many are performed manually.



Research scientist operates nuclear magnetic resonance instrument.

Occupations in the Industry

Workers with many different levels of skill and education are employed in the drug industry. More than half of the industry's workers are in white-collar jobs (scientific, technical, administrative, clerical, and sales); most of the remainder are in plant jobs (processing or production, maintenance, transportation, and custodial).

Nearly two-fifths of the drug industry's workers are women, a higher proportion than in most other manufacturing industries. Most of them are semiskilled plant workers and office workers. Some are scientists and technicians.

The duties of some of the important occupations are described briefly below. (Detailed discussion of professional, technical, clerical and other occupations found in drug manufacturing, as well as in other industries, are given elsewhere in this *Handbook*, in the sections covering individual occupations.)

Scientific and Technical Occupations. About 1 out of every 5 employees in the industry is a scientist, engineer, or technician—a far greater proportion than in most other industries. The majority research and develop new drug products. Others work to streamline production methods and improve quality control.

Chemists (D.O.T. 022.081, .168, .181) comprise over one-fourth of the scientific and technical personnel in the industry. *Organic chemists* combine new compounds for biological testing. *Physical chemists* separate and identify substances, determine molecular structure, help to create new compounds and improve manufacturing processes. *Biochemists* study the action of drugs on body processes and cells. *Radiochemists* trace the course of drugs through body organs and tissues. *Pharmaceutical chemists* set standards and specifications for form of product and storage conditions and see that labeling and literature meet the requirements of State and Federal laws. *Analytical chemists* test raw and intermediate materials and finished products for quality.

Over one-fifth of the industry's scientific and technical workers are biological scientists (D.O.T. 041.081, .181, and 049.384). *Biologists* and *bacteriologists* study the effect of chemical agents on infected animals. *Microbiologists* grow strains of microorganisms which produce antibiotics. *Physiologists* investigate the effect of drugs on, for example, reproduction and circulatory functions. *Pharmacologists* and *zoologists* study the therapeutic and toxic effect of drugs on animals. *Virologists* grow viruses, develop vaccines, and test them in animals. *Botanists* with their special knowledge of plant life, contribute to the discovery of botanical ingredients for drugs. Some other biological scientists include *pathologists*, who study normal and abnormal cells or tissues, and *toxicologists*, who are concerned with the safety, dosage levels, and the compatibility of different drugs. *Pharmacists* perform research in product development, compounding and studying many forms of medicines at various stages of production. Some set specifications for the purchase and manufacture of materials, and handle correspondence relating to products. Drug manufacturers also employ physicians and veterinarians.

Engineers make up about one-twelfth of scientific and technical employment. *Chemical engineers* (D.O.T. 008.081) design equipment and devise manufacturing processes. *Industrial engineers* (D.O.T. 012.081, .168, .187, .188, and .281) plan equipment layout and workflow to maintain efficient utilization of plant facilities. *Mechanical engineers* (D.O.T. 007.081, .151, .168, .181, and .187) coordinate the installation and maintenance of sterilizing, heating, cooling, humidifying, and ventilating equipment.

Technicians (D.O.T. 073.381, 078.128, .168, .281, .368, .381, and .687) represent over one-fifth of the drug industry's scientific and technical workers. Laboratory tests play an important part in the detection and diagnosis of a disease and in the discovery of medicines. Laboratory technicians perform these tests under the direction of scientists in such areas as bacteriology, parasitology, biochemistry, microbiology, virology (the study of viruses), cytology (analysis of blood cells), and nuclear medical technology (the use of radioactive isotopes to help detect diseases).

Administrative, Clerical, and Related Occupations. About 1 out of every 3 workers in drug manufacturing is in an administrative, clerical, or other office job. At the top of the administrative group are the executives who make policy decisions concerning matters of finance, marketing, and types of products to research and develop. Other administrative and executive workers are accountants, lawyers, purchasing agents, personnel and industrial relations workers, and advertising and market research workers. Clerical employees keep records on personnel, payroll, raw materials, sales, shipments, and plant maintenance.

Salesmen, often called pharmaceutical detail men, represent a small (three percent) but important group of drug industry employees. Detail men are employed and trained by drug manufacturers to inform physicians of the availability and appropriate utilization of the company's products. They visit practicing and teaching physicians, pharmacists, dentists, and hospital administrators to distribute samples of and information on the latest products. Other functions include reporting information from customers back to their companies and transmitting knowledge and experience from one user to another.

Plant Occupations. Nearly half of the industry's employees work in plant jobs. The majority of these workers can be divided into three major occupational groups: production or processing workers who operate the drug producing equipment; maintenance workers who install, maintain, and repair machinery and other equipment; and truck drivers, shipping clerks, and material handlers who help transport the drugs.

Pharmaceutical operators (D.O.T. 559.782) control machines that produce tablets, capsules, ointments, and medicinal solutions. *Granulator machine operators* (D.O.T. 559.-782) tend milling and grinding machines that reduce mixtures to designated sized particles. *Compounders* (D.O.T. 550.885) operate tanks and kettles in which solutions are mixed to make up creams, ointments, liquid medications, and powders. *Compressors* (D.O.T.

Pharmaceutical salesman informs physician of latest product information.

556.782) operate machines that compress ingredients into tablets. *Pill and tablet coaters* (D.O.T. 554.782) control a battery of machines that apply coatings to tablets to flavor, color, preserve, add medication, or control disintegration time. *Tablet testers* (D.O.T. 559.687) inspect tablets for hardness, chippage, and weight to assure conformity with specifications. *Ampoule fillers* (D.O.T. 559.885) operate machines that fill ampoules (special glass containers) with measured doses of liquid drug products. *Ampoule sealers* (D.O.T. 559.887) melt the glass at the neck of the ampoule in order to seal it. *Ampoule examiners* (D.O.T. 559.687) examine the ampoules for discoloration, foreign particles, and flaws in the glass.

After the drug product is prepared, it is inspected, and bottled or packaged. Most of the inspection and bottle filling jobs are done by women operating machines that measure exact amounts of the product and seal containers.

The drug industry employs many skilled maintenance workers to assure that production equipment is operating properly and to prevent costly breakdowns. Included among maintenance workers are *power plant operators* who are responsible for high pressure boilers, turbo generators, compressors, refrigeration equipment, and plant water systems; *electricians* who install, maintain and repair wiring, motors, switches, and other electrical equipment; *pipefitters* who install and maintain heating, plumbing, pumping, and hot water systems; *machinists* who make and repair metal parts for machines and equipment; and *instrument repairmen* who periodically inspect instruments and controls and repair or replace malfunctioning parts.

Pharmaceutical operator tends capsule filling machine.

Plant workers who do not operate or maintain equipment perform a variety of other tasks. Some drive trucks to make deliveries to other parts of the plant; some load and unload trucks and railroad cars; and others keep inventory records of stock and tools. The industry also employs custodial workers, such as guards and janitors, whose duties are similar to those of such workers in other industries.

Training, Other Qualifications, and Advancement

The training requirements for jobs in the drug industry range from a few hours of on-the-job training to years of preparation.

For production and maintenance occupations, drug manufacturers generally hire inexperienced workers and train them on the job; young high school graduates are preferred by most firms. Unskilled men who start in production assist more skilled workers in the performance of their duties, while learning the operation of the processing equipment. With experience, an employee may advance to more skilled jobs in his department. Most maintenance jobs are filled by young men who start as helpers to electricians, pipefitters, machinists, and other craftsmen.

Many companies encourage production and maintenance workers to take courses related to their jobs in local schools and technical institutes, or to enroll in correspondence courses. Some companies reimburse the workers for part, or all, of the tuition. Skilled production and maintenance workers with leadership ability may advance to supervisory positions.

For technicians in the drug industry, methods of qualifying for jobs vary in many ways. Most technicians enter the field with a high school degree and advance to jobs of greater responsibility after they have acquired experience and additional formal education. However, companies prefer to hire men and women who are graduates of technical institutes or junior colleges, or those who have completed college courses in chemistry, biology, mathematics, or engineering. In many firms, inexperienced workers begin as laboratory helpers or aids, performing routine jobs such as cleaning and arranging bottles, test tubes, and other equipment.

The experience required for higher levels of technician jobs varies from company to company. Generally, one year of experience is usually required for assistant technician jobs, 3 years for technicians, 6 years for senior technicians, and 10 years for technical associates. Some companies require senior technicians and technical associates to complete job-related college courses.

For most scientific and engineering jobs, a bachelor of science degree from a recognized college is the minimum requirement. Some companies have formal training programs for young college graduates with engineering and scientific backgrounds. These trainees work for brief periods in the various divisions of the plant to gain a broad knowledge of drug manufacturing operations before being assigned to a particular department. In other firms, newly employed scientists and engineers are immediately assigned to a specific activity such as research, process development, production, or sales.

Job prospects and advancement are usually best for professionals with advanced degrees. Some companies offer training programs to help scientists and engineers keep abreast of new developments in their fields and to develop administrative skills. These programs may include meetings and seminars with consultants from academic and nonacademic fields. Most companies encourage scientists and engineers to further their education; some provide financial assistance for this purpose. Publication of scientific papers is also encouraged.

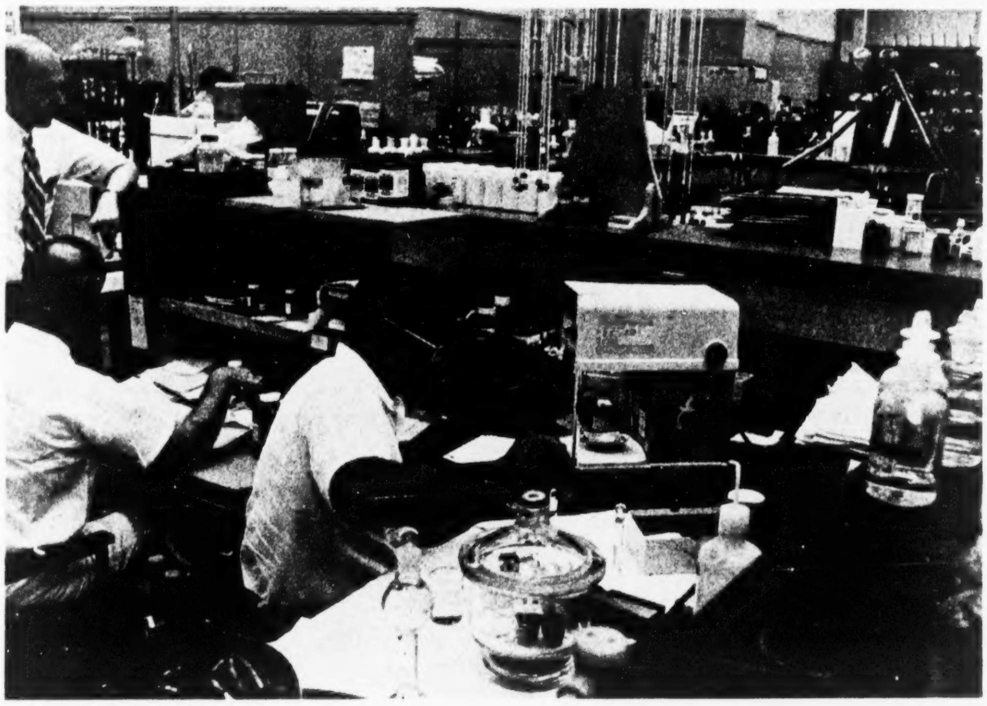
Employment Outlook

Drug manufacturing employment is expected to grow rapidly through the 1970's, creating several thousand job openings annually. Additional openings will result from the need to replace experienced workers who transfer to other fields of work, retire, or die.

The demand for drug products is expected to grow very rapidly. Demand will be stimulated primarily by increases in population—particularly the growing number of older people and children. Other factors which are expected to increase the demand for drugs include greater personal income levels, the rising health consciousness of the general public, growth of coverage under prepayment programs for hospitalization and medical care (including Medicare), and the discovery of new drugs that will be effective in treating illness not yet responding to drug therapy.

The industry's employment will not increase as rapidly as the demand for drug products, because technological improvements in production methods will increase output per worker. The more widespread use of automatic processing and control equipment in operations formerly done by hand will tend to reduce labor requirements, particularly in plants where products such as tablets, ointments, and liquid medicines are mass-produced.

Rates of employment growth will vary greatly among occupations. The numbers of scientists, engineers, detail men, technicians, and maintenance workers are expected to increase faster than other occupational groups in the industry. Demand for scientists, engineers, and technicians will be stimulated by continued growth in research and development activities. The increasingly technical nature of the detail man's job and the rising demand for drug products are expected to make this occupation one of the most rapidly growing in the industry. More skilled maintenance men, such as electricians, machinists, pipefitters, and instrument repairmen will be needed to service the growing amount of automatic processing and control equipment. Employment of administrative and clerical workers is expected to increase moderately; however, most semiskilled plant occupations are expected to increase slowly, as more processes are adapted to automatic equipment.


Technician uses complex equipment in the laboratory.

Earnings and Working Conditions

Earnings of plant workers in the drug industry are higher than the average for manufacturing industries. For example, in 1970, production workers in the drug industry averaged $143.37 for a 40.5 hour week, or $3.54 an hour. In comparison, production workers in manufacturing as a whole averaged $133.73 for a 39.8 hour week, or $3.36 an hour.

National wage data are not available for individual occupations in the drug industry. However, the following tabulation, based on data obtained from one of the Nation's largest drug manufacturers, provides an example of ranges in weekly earnings for selected occupations in 1969.

Many employees work in plants that operate around the clock—three shifts a day, 7 days a week. In most plants, workers receive extra pay when assigned to second or third shifts. They also receive premium pay for working more than 40 hours a week. Most of the industry's workers have year round employment because drug production is not subject to seasonal variations.

Paid vacations and holidays are common in this industry. Workers generally receive 2 weeks of vacation after 1 year of employment, 3 weeks after 5 years, 4 weeks after 15 years, and 5 weeks after 25 years. Most workers also receive insurance and pension benefits, financed at least partially by their employers. These benefits include life, sickness, accident, hospitalization, and surgical insurance. Employee stock-purchase plans are in effect in many firms.

Working conditions in drug plants generally are better than in other manufacturing plants. Because of the danger of contaminating drugs, much emphasis is placed on keeping equipment and work areas clean. Plants usually are air-conditioned, well-lighted, and quiet. Ventilation systems protect workers from dust, fumes, and disagreeable odors. Special precautions are taken to protect the relatively small number of employees who work with diseased cultures and poisonous chemicals. With the expection of work performed by materials handlers and maintenance workers, most jobs require little physical effort. The frequency of injuries in drug manufacturing has been about half the average for all manufacturing industries in recent years.

Many of the industry's employees are members of labor unions. The principal unions in the industry are the Oil, Chemical and Atomic Workers International Union; the International Chemical Workers Union; and District 50, United Mine Workers of America (Ind.)

Examples of earnings of workers in a large drug manufacturing firm in 1969

Plant occupations	*Minimum*	*Maximum*
Processing:		
Unskilled	$ 98.31	$162.46
Semiskilled	117.92	184.62
Skilled	128.31	205.38
Supervisor	138.69	265.62
Maintenance:		
Helper	113.31	162.46
General mechanic	128.31	205.38
Carpenter, Pipefitter	130.62	215.31
Electrician, Machinist	134.08	226.38
Instrument repairman	135.23	233.77
Supervisor	138.69	265.62
Technical occupations		
Beginning technician	111.00	158.77
Laboratory technician I	116.77	168.69
Laboratory technician II	123.69	193.15
Laboratory technician III	130.62	215.31
Technical associate	130.62	241.15
Professional occupations		
Biologist, chemist, pharmacist	186.54	(1)
Engineer	200.00	(1)
Veterinarian	269.23	(1)
Physician	384.62	(1)

[1] = not available.

Where To Go For More Information

Further information concerning careers in drug manufacturing may be obtained from the personnel departments of individual drug manufacturing companies and from:

Pharmaceutical Manufacturers Association, 1155 Fifteenth St. NW., Washington, D.C. 20005

National Pharmaceutical Council, Inc., 1030 15th St. NW., Washington, D.C. 20005

The Proprietary Association, 1700 Pennsylvania Ave. NW., Washington, D.C. 20006

OCCUPATIONS IN ELECTRONICS MANUFACTURING

The science of electronics has contributed greatly to the achievements of the age in which we live. Electronic instruments guide unmanned missiles for our Nation's defense and control the flights of our astronauts. Other electronic instruments make it possible for man to communicate over vast distances. Electronic devices direct, control, and test production processes in industries such as steel and chemicals. Electronic data-processing equipment enables business and government to handle tons of paper work with great accuracy and speed. Hospitals use electronic instruments to perform laboratory tests and to check body functions. In homes, television and radio receivers provide information and entertainment. Indications are that electronics will play an even greater role in the future.

In 1970, an estimated 1.1 million workers were employed in electronics manufacturing in a wide range of occupations. Job requirements varied from graduate college degrees for some scientists and engineers to a few days of on-the-job training for some plant workers. A very rapid increase in employment is anticipated through the 1970's. Job opportunities are expected to be particularly favorable for engineers, scientists, technicians, and skilled maintenance workers. Many job opportunities also will be available for semiskilled plant workers.

Nature and Location of Electronics Manufacturing

Electronic products may be grouped into four major categories: (1) government products, (2) industrial products, (3) consumer products, and (4) components. In 1970, government products accounted for nearly half of total electronic sales. Industrial products accounted for about one-third, and consumer products accounted for about one-seventh. Components produced as replacement parts were only a small percentage of total sales. (Components produced as original equipment for end products are included in the shipments value of the end products.)

Government products include electronic guidance and tele-metering systems for missiles and spacecraft; radar and other detection devices; automatic communications and computing systems; gyroscopes and other navigational equipment; and fire controls (such as air-to-air target seeking and detonating equipment). Government products are also used in the fields of medicine, education, crime detection, and traffic control.

Important industrial electronic products include computers; commercial radio and television broadcasting equipment; commercial and private aircraft communications and navigational apparatus; and industrial testing, measuring, and production control equipment. Principal consumer products include television sets, radios, phonographs, tape recorders, and hearing aids.

Electronic components fall into three broad classifications: tubes, semiconductors, and "other components." Tubes include receiving tubes, power tubes, television picture tubes, and special purpose tubes. Principal semiconductor devices are transistors, diodes, rectifiers, and microelectronic devices, which include combinations of miniaturized semiconductors. "Other components" include items such as capacitors, antennas, resistors, transformers, relays, connectors, and electronic switches.

Of the estimated 1.1 million workers employed in electronics manufacturing establishments in 1970, about three-fifths—670,000 worked in plants producing end products. About 355,000 of these workers produced military and space equipment; 200,000 produced industrial and commercial products; and 115,000 produced consumer items. The remaining 405,000 workers were in plants making electronics components.

Electronics manufacturing plants are located in nearly every State, but the majority of electronics manufacturing workers in 1970 were employed in eight States: California, New York, New Jersey, Illinois, Massachusetts, Ohio, Pennsylvania, and Indiana. Metropolitan areas with large numbers of electronics manufacturing workers included Chicago, Los Angeles, New York, Philadelphia, Newark, Boston, Baltimore, and Indianapolis.

In addition to the employees in electronics manufacturing plants, about 80,000 electronics workers were employed by the Federal Government in activities such as research, development, and the negotiation and administration of contracts. A relatively small number of electronics workers were employed by universities and nonprofit research centers.

Electronics Manufacturing Occupations

A wide variety of occupations, requiring a broad range of training and skills, is found in plants manufacturing electronic products. About half the workers in electronics manufacturing are in plant jobs (production, maintenance, transportation, and service); the rest are in white-collar jobs (engineering, scientific, finance, administrative, clerical, and sales).

The proportions of plant and white-collar workers differ from one establishment to another, depending mainly on the products being manufactured. For example, the proportion of plant workers is generally higher in establishments producing consumer products than in establishments manufacturing government products.

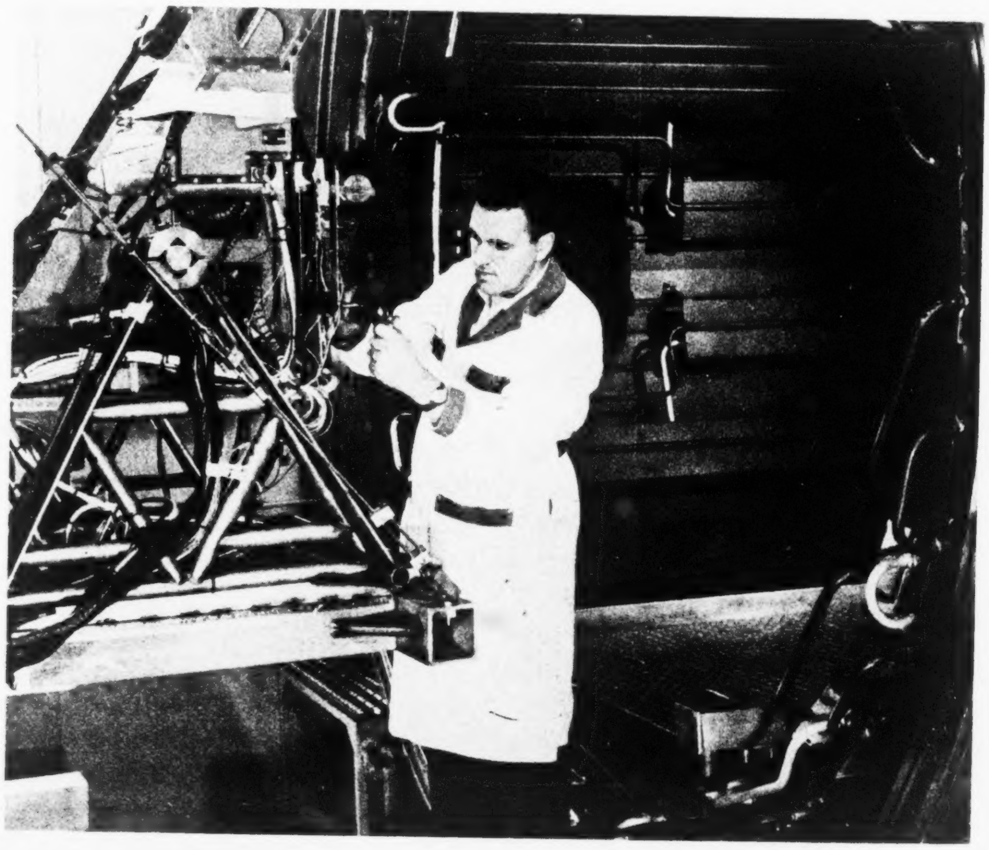
More than two-fifths of the workers employed in electronics manufacturing plants are women. In some plants, particularly those producing electron tubes and semiconductors, women account for half or more of total employment. Most women are employed as semiskilled plant workers, chiefly as assemblers, inspectors, and testers, and as office workers. However, opportunities for women exist in nearly all types of jobs in electronics manufacturing.

Professional and Technical Occupations. A large proportion of electronics manufacturing workers are in engineering, scientific, and other technical jobs. Engineers and scientists alone represent about 1 out of every 9 electronics workers. Generally, they account for a much larger proportion of employment in plants making military and space equipment than in those producing other types of electronic products.

The largest group of engineers is electrical or electronics engineers. They generally are employed in research and development, although many work in production operations as design engineers or as test methods and quality control engineers. Electronics engineers also work as field engineers, sales engineers, or engineering liaison men.

Substantial numbers of mechanical engineers and industrial engineers also are employed in electronics manufacturing plants. Mechanical engineers work as design engineers in product development and in tool and equipment design. They work also as plant engineers—chiefly concerned with the maintenance layout and operation of plant equipment. Most industrial engineers work as production engineers or as efficiency, methods, or time-study engineers. Other engineers employed in electronics manufacturing include chemical, metallurgical, and ceramic engineers.

Physicists make up a large group of scientists in electronics manufacturing. Now that smaller package circuitry has been achieved through the development of microminiaturization, physicists are working to produce the complete circuit. This process is accomplished by integrating elements that duplicate the functions formerly performed by discrete components such as capacitors, resistors, and inductors, together with transistors. Many scientists in electronics manufacturing are chemists and metallurgists, employed mainly in research work and in materials preparation and testing. Mathematicians and statisticians work with engineers and scientists on complex mathematical and statistical problems, especially in the design of military and space equipment and computers. Statisticians also are employed in the fields of quality control, production scheduling, and sales analysis and planning. Industrial designers work on the design of electronic products and the equipment used to manufacture them.



Electronics engineer adjusts instrument panel of spacecraft.

Technicians—such as electronics technicians, draftsmen, engineering aids, laboratory technicians, and mathematical assistants—represent about 1 out of every 20 electronics manufacturing workers.

Many electronics technicians are engaged in research and development work, helping engineers in the design and construction of experimental models. They also are employed by manufacturers to work on electronic equipment in customers' establishments. Other electronics technicians work in highly technical inspecting, testing, and assembly jobs in the engineering laboratories of firms manufacturing electronic products.

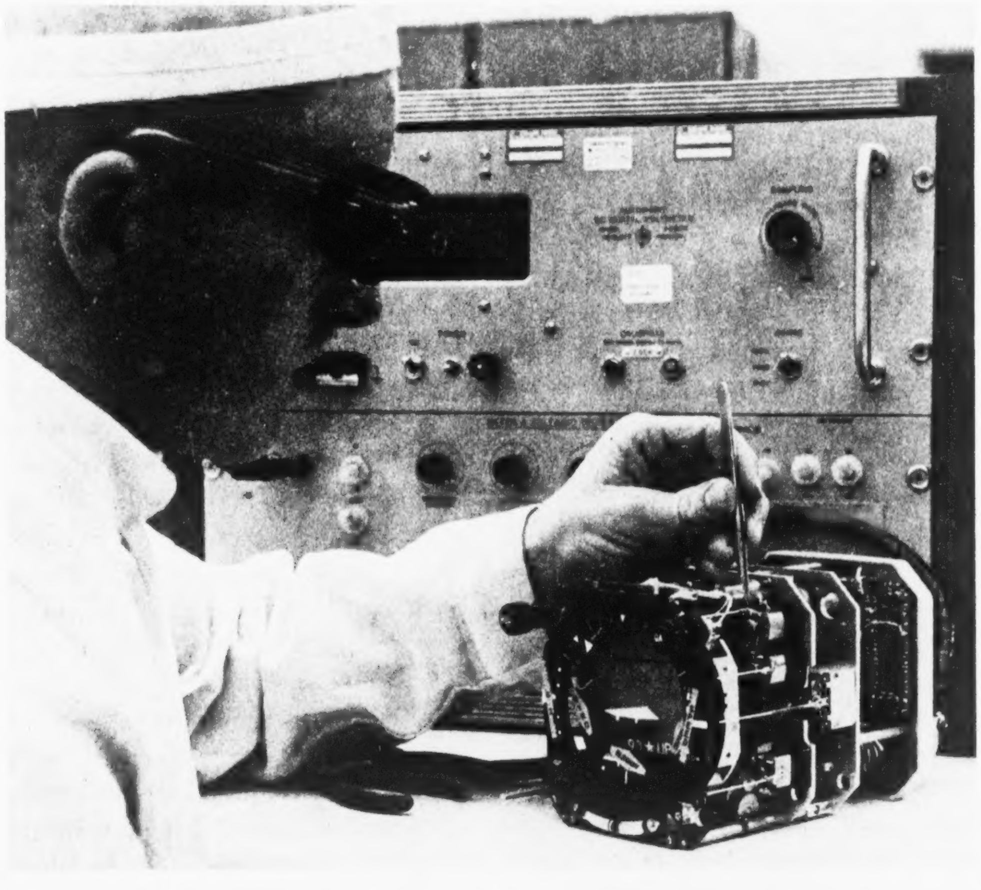
Draftsmen usually are employed in engineering departments to prepare drawings from sketches or specifications furnished by engineers. Manufacturers of military and space equipment generally employ a higher proportion of draftsmen than do manufacturers of other types of electronic products.

Engineering aids are another important group of technicians. They assist engineers by making calculations, sketches, and drawings, and by conducting performance tests on components and systems. Laboratory technicians help physicists, chemists, and engineers by performing duties such as setting up apparatus and assisting in laboratory analyses and experiments. Some laboratory technicians themselves may conduct analyses and experiments, usually of a standardized, routine nature. Mathematical assistants help to solve mathematical problems, following procedures outlined by mathematicians. They also operate test equipment used in the development of electronic computers.

Technical writers work closely with engineers, particularly in plants making government and industrial products, and in establishments doing research and development work. They prepare training and technical manuals describing the operation and maintenance of electronic equipment. They also prepare catalogs, product literature, and project reports and proposals. Specifications writers compile lists of required measurements and materials. Technical illustrators draw pictures of electronic equipment for technical publications and sales literature.

Administrative, Clerical, and Related Occupations. About 1 out of 5 workers in electronics manufacturing plants is in an administrative or other office job. Administrative workers include purchasing agents, sales executives, personnel workers, advertising personnel, and marketing research specialists. Clerks, secretaries, stenographers, typists, and business machines operators, many of whom are women, are among the thousands of other office workers employed by electronics manufacturing firms. A small but growing proportion of these office workers operate electronic computers and auxiliary equipment. Most of these computers are used to process office records, including payroll, production, costs, sales, and inventory data.

Plant Occupations. About half of electronics manufacturing employees work in assembly, inspecting and testing, machining, fabricating, processing, maintenance, and other plant operations. The proportion of workers in each of these op-



Technician tests aircraft flight director indicator in clean room atmosphere.

erations differs among electronics plants, depending largely on whether end products or components are produced and the types manufactured. For example, the proportion of assemblers is higher in plants making components and consumer end products than in plants producing military space equipment and industrial-commercial products. The proportion of machining and fabricating workers is higher among manufacturers of military space equipment and industrial-commercial products than among manufacturers of other types of products.

Assembly Occupations (D.O.T. 729.884; 720.884; 726.781 and .884). Assemblers make up the largest group of electronics plant workers. Both end-product and component manufacturing firms employ assemblers with many different skills. However, most assemblers are semiskilled workers.

Most end products are assembled mainly by hand, using small handtools, soldering irons, and light welding devices. Assemblers use diagrams, models, and color-coded parts and wires to help them in their work. Some assembly work is done by following instructions presented on color slides and tape recordings. Color slides flash a picture of an assembly sequence on a viewing screen, while the assembler listens to recorded directions.

Precision assemblers install components and subassemblies into end products in which moving parts and mechanisms must operate within clearances measured in thousandths, or even millionths, of an inch. Some of these assembly workers do repair work, experimental and developmental work, and model assembly work. Most precision assemblers are employed in the manufacture of military space and industrial-commercial electronic equipment.

Machines are used in some assembly work on end products. For example, in putting together subassemblies such as circuit boards, automatic machines often are used to position components on the boards and to solder connections. Here the assemblers work as machine operators or loaders.

Most components are assembled by machines, since their assembly involves many separate but simple and repetitive operations. Even some types of miniaturized semiconductors and other components, made with parts small enough to pass through the eye of a needle, now are assembled on highly complex machines. Some of these machines are automatically controlled.

Hand assembly is needed for some components, such as receiving tubes and special purpose tubes, and some types of transistors, diodes, capacitors, and resistors. Hand assemblers may perform only a single operation on these components as they move down the assembly line, but some may assemble completely a particular type of component. Tiny components often are hand-assembled under magnifying lenses or powerful microscopes.

Hand assemblers may use machines to assist them in performing assembly operations on components. For example, precision welding equipment may be used to weld connections in microminiature components and circuit assemblies. Some circuit assemblies are so small that hundreds of components may be precision welded in a cubic inch of space. Machines also may be used to position and hold component parts during assembly operations.

Hand assemblers also are employed in electronics research laboratories and in the research and development departments of electronics manufacturers. These workers —frequently called electronics technicians—generally do difficult assembly work on small quantities of complex, often experimental, equipment. They also may work on the development of new ways to assemble large quantities of components or subassemblies by machine. Some electronics technicians install subassemblies into complex systems such as those in guided missiles. These hand assemblers usually must know enough electronics theory to understand the operation of the items being assembled.

Most assemblers are women. They are employed mainly as machine operators or tenders, and as hand assemblers of items made in large quantities. Men are employed chiefly in experimental assembly work, in model assembly, and in assembly jobs requiring relatively heavy work. Men also are employed in assembly departments as "trouble shooters." These workers analyze end products and subassemblies, which have failed routine performance tests, to pinpoint the cause of faulty operation.

Machining occupations. Metal machining workers are employed in most electronics manufacturing plants, particularly those making military-space and industrial-commercial products. Machine-tool operators and machinists operate power-driven machine tools to produce metal parts of electronic products. Toolmakers construct and repair jigs and fixtures used in the fabrication and assembly of parts. Diemakers specialize in making metal forms (dies) used in punch and power presses to shape metal parts.

Fabricating occupations. Fabricating workers are employed in many electronics manufacturing plants, but the largest proportion is in establishments producing industrial products. Among the fabricating workers are sheet-metal workers who make frames, chassis, and cabinets. *Glass blowers* and *glass lathe operators* (D.O.T. 674.782) are employed chiefly in electronic tube experimentation and development work; in the manufacture of special purpose tubes, which are made in small numbers; and in rebuilding television picture tubes. Other fabricating workers include *punch press operators, blanking machine operators* and *shear operators.*

Some fabricating jobs involve the molding, firing, and glazing of ceramics used as insulating materials in many components. Workers may also operate machines that mold plastic components. In electron tube manufacturing, special fabricating workers are employed. For example, *grid lathe operators* (D.O.T. 725.884) make grids (devices in electronic tubes which control the flow of electrons) by winding fine wire around two heavy parallel wires. Other fabricating workers include *spot welders, coil winders* (D.O.T. 724.781 and .884) and *crystal grinders* and *finishers* (D.O.T. 726.884).

Processing occupations. A relatively small but important group of electronics manufacturing workers is engaged in processing activities, chiefly in plants producing electronic components. *Electroplaters* and *tinners* (D.O.T. 501.885) coat many parts with metal. *Anodizers* (D.O.T. 501.782) treat parts in electrolytic and chemical baths to prevent corrosion. *Silk screen printers* (D.O.T. 726.887) print patterns on circuit boards and on parts of electronic components. *Etching equipment operators* (D.O.T. 590.-885) do chemical etching of copper on circuit boards.

Processing workers also impregnate or coat coils and other electronic components with waxes, oils, plastics or other materials. Some operate machines which encase microminiature components in plastic resin to join and insulate them in circuits, seal out moisture, and reduce chances of connection failure caused by heat and vibration.

Another group of processing workers operate furnaces, ovens, and kilns, used chiefly to harden ceramics, bake on coatings, and eliminate contamination by gases and foreign materials. *Operators of infrared ovens and hydrogen furnace fires* (D.O.T. 590.885) rid tubes of foreign deposits. In tube manufacturing, *exhaust operators* (D.O.T. 725.884) and *sealers* (D.O.T. 692.885) operate gas flame machines which seal the mount (the part of an electronic tube consisting of a Bakelite base and stem) in the tube, clear the tube of impurities, exhaust the gas, and seal the tube.

Testing and inspection. Testing and inspection in electronics manufacturing begin when raw materials enter the plants and continue throughout fabricating operations. Finished components and end products undergo thorough testing and inspection, frequently including operation for a period of time, before shipment.

In end-product manufacturing plants, testers use voltmeters, oscilloscopes, and other test meters to make certain that components, subassemblies, and end products conform to specifications. Many of these workers have job titles that indicate the type of work they do, such as analyzer, final tester, tuner tester, and operational tester.

Some testing jobs require technically trained workers who have had several years of experience in electronic testing. These jobs are commonly found in research and development work, where electronics technicians test, adjust, and aline circuits and systems as part of their overall responsibility. These jobs also are found in complex production work, such as the manufacture of missiles and spacecraft.

In component manufacturing plants, components are checked manually by testers using various types of test meters or routed mechanically through automatic test equipment. Some automatic equipment can check a large number of component characteristics, produce a punched tape of test results, and sort the components into batches for shipping. Although many of these workers simply are called component testers, others have job titles which reflect the type of components they test, such as transformer tester or coil tester. Workers who feed or monitor automatic test equipment often are called test-set operators or testing-machine operators.

The work of inspectors in end-product plants varies from checking incoming materials to inspecting subassemblies and final products for flaws in circuit assembly, etching, plating, painting, and labeling. *Electronic assembly inspectors* (D.O.T. 722.281) examine assembled electronic units to make certain that they conform to blueprints and specifications, and check wire routing, electrical connections, and quality of units. Mechanical and precision inspectors check mechanical assemblies and precision parts. Inspectors in end-product plants may use tools such as measuring scales, micrometers, calipers, and magnifying glasses in their work.

Inspectors in component manufacturing plants check incoming raw materials and subassemblies before, during, and after fabricating and processing operations. They may inspect wire leads on diodes for straightness or length, wire winding on coils for evenness or breakage, and completed tubes for loose wires, scratched paint, corrosion, defective etches, and identifying labels. Some inspectors make repairs on defective components.

Tools used by inspectors in components plants may include magnifying lenses, micrometers, calipers, tweezers, and, in some circumstances, microscopes. These inspectors may have job titles that indicate the work they do, such as incoming materials inspector, plating inspector, power tube inspector, coil inspector, machine parts inspector, and precision inspector.

Maintenance occupations. Many workers are employed in electronics manufacturing plants to maintain machinery and equipment. Skilled electricians are responsible for the proper operation of electrical equipment. Machine and equipment repairmen perform mechanical repairs. Hydraulic mechanics specialize in maintaining hydraulic equipment. Maintenance machinists and welders build and repair equipment, jigs, and fixtures. Air-conditioning and refrigeration mechanics are employed in electronics plants which are air-conditioned and have special refrigerated and dust-free rooms. Painters, plumbers, pipefitters, carpenters, sheet-metal workers, and other building maintenance craftsmen also are employed in electronics plants.

Other plant occupations. Parts changer (D.O.T. 729.381) is another important occupation in electronic manufacturing plants. These workers repair assembled electronic products which have been tagged for replacement of defective parts. Women frequently are employed as parts changers.

Many workers are employed in materials movement and handling. These workers include operators of plant trucks and tractors; forklift operators who stack crates and load and unload trucks and boxcars; and truckdrivers who handle transportation outside the plant. Other occupations include boiler operator and stationary engineer.

(Detailed discussions of professional, technical, mechanical, and other occupations, found not only in electronics manufacturing plants but also in other industries, are given elsewhere in the *Handbook* in sections covering the individual occupations.)

Training, Other Qualifications, and Advancement

Electronic manufacturing plants employ many engineers, scientists, and technicians because of the technical nature of plant production operations and the great emphasis on research and development work. Beginning engineering jobs usually are filled by recent graduates of engineering colleges (some with advanced degrees). A small number of workers without college degrees are upgraded to professional engineering classifications from occupations such as engineering assistant and electronics technician. Workers who become engineers in this way usually have taken advanced electronics courses in night school or in other training programs. To keep up with new developments in their fields and to help them qualify for promotion, professional and technical personnel obtain additional training, read technical publications, and attend lectures and technical demonstrations.

Almost all mathematicians, physicists, and other scientists employed in electronics manufacturing plants have college degrees, and many have advanced degrees. Job prospects are usually better for scientists who have at least a master's degree than for those with only a bachelor's degree.

Technicians generally need some specialized training to qualify for their jobs. Most electronics technicians have attended either a public, private, or Armed Forces technical school. Some have obtained their training through apprenticeships, usually of 3 or 4 years' duration. Applicants with a high school education including courses in mathematics and science, are preferred for these apprenticeships. Some workers become electronics technicians by being upgraded from jobs such as tester and experimental assembler, after they have developed skills on the job and acquired the necessary knowledge in basic electronics theory, mathematics, drafting, and reading of schematic diagrams. This knowledge usually is obtained by taking courses in company-operated classes, night school, junior college, technical school, or by correspondence.

Electronics technicians need color vision, manual dexterity, and good eye-hand coordination. As in the case of other technical workers, they must be able to understand technical publications. Some technicians who do final testing that requires the operation of radio transmitting equipment must hold licenses from the Federal Communications Commission as first- or second-class commercial radiotelephone operators.

Laboratory technicians engineering and scientific aids, and mathematical assistants frequently have had 1 year of college training or more in a scientific or engineering field, but have not completed course requirements for a degree. In other cases, these workers have been upgraded from jobs as lower grade assistants in engineering laboratories or as high-grade testers in production departments. In hiring lower grade assistants, electronics firms give preference to applicants who have completed high school courses in mathematics, physics, and chemistry.

Draftsmen usually enter their trade by taking a course in drafting at a trade or technical school; a few have completed a 3- or 4-year apprenticeship. Some qualify for their jobs under an informal arrangement with their employers which provides for both on-the-job training and part-time schooling. Because many draftsmen must understand the basic principles of electronic circuits to do their work, they should study basic electronic theory and circuits and the reading of electronic schematic diagrams.

Technical writers must have a flair for writing and are usually required to have some technical training. Electronics firms prefer to hire those who have had some technical institute or college training in science or engineering. Some have college engineering degrees. Many have college degrees in English and journalism and have received their technical training on the job and by attending company-operated evening classes. Technical illustrators usually have attended special schools of art or design.

Many tool and die makers, machinists, electricians, pipefitters, carpenters, and other craftsmen learn their trades by completing a 4- or 5-year apprenticeship. Some enter these trades through upgrading from helpers' jobs. Some take courses at vocational schools.

Formal training in electronics usually is not necessary for workers entering plant jobs, but completion of high school frequently is required. Job applicants may have to pass aptitude tests and demonstrate skill for particular types of work.

On-the-job training, usually for a short period, generally is provided for workers who have had no previous experience. Assemblers, testers, and inspectors need good vision, good color perception, manual dexterity, and patience.

Requirements for filling administrative and other office jobs are similar to those in other industries. Certain beginning administrative jobs in electronics manufacturing generally are open only to college graduates having degrees in business administration, accounting, or engineering. More and more employers are requiring college training for administrative jobs in advertising, personnel, accounting, and sales. For clerical jobs, employers usually prefer applicants who are high school graduates with special training in stenography, typing, bookkeeping, and office machine operation.

Employment Outlook

Employment in electronics manufacturing is expected to increase very rapidly through the 1970's. In addition, large numbers of job openings will result from the need to replace workers who transfer to other fields of work, retire, or die.

The employment outlook presented here assumes relatively full employment in the Nation's economy and the high levels of economic activity needed to achieve this goal. It also assumes that defense expenditures, an important determinant of electronics manufacturing employment, will be somewhat higher than the level before the Vietnam buildup; approximately the level of the early 1960's. If the Nation's economic activity and defense expenditures should differ substantially from the assumed levels, employment will be affected accordingly.

Several factors will stimulate growth in the output of electronic products. Businessmen are expected to spend increasing amounts for computers and other electronic equipment to automate and mechanize data processing and production processes. Business expenditures for communications and industrial testing equipment also will grow. The demand for consumer items, such as television receivers and stereo systems, will rise in response to increases in population, family formations, and personal incomes. Government purchases for defense needs will continue to account for a large proportion of electronics manufacturing output. An increasing share of government purchases, however, is likely to be for electronic equipment used in medicine, education, pollution abatement, and most other nondefense related fields.

The increase in electronics manufacturing employment will not be as great as the expansion in output, however, because technological improvements in production methods are expected to increase output per worker. For example, increasing mechanization of operations formerly done by hand will tend to reduce labor requirements, particularly in plants where products are mass-produced, such as television and radio sets, and components. However, mechanized manufacturing processes are difficult to adapt to the fabrication of many types of highly complex electronic products.

Although total employment in electronics manufacturing is expected to grow at a very rapid pace through the 1970's, the rates of growth will vary among occupational groups and individual occupations. For example, employment of skilled maintenance personnel, particularly instrument repairmen, is expected to rise at a more rapid rate than total employment because of the need to maintain and repair the increasing amounts of complex machinery. On the other hand, employment of semiskilled workers probably will rise at a slower rate because of the growing mechanization and automation of assembly line operations.

Employment of engineers, scientists, and technicians is expected to increase faster than total employment because of continued high expenditures for research and development, and the continuing trend toward the production of complex equipment. Among professional and technical workers, the greatest demand will be for engineers having advanced degrees, particularly those who have a background in certain specialized fields, including quantum mechanics, solid-state circuitry, product design, and industrial engineering. Many opportunities also will be available for engineers possessing selling ability because the increasing complexity of industrial and commercial equipment will require salesmen with highly technical backgrounds. The demand for mathematicians and physicists will be particularly good because of expanding research in computer and laser technology.

Earnings and Working Conditions

Average hourly and weekly earnings of production workers in electronics manufacturing industries vary considerably by type of product produced. As shown in the accompanying tabulation, production workers in industries making government and industrial end products had higher average earnings in 1970 than those in industries producing other types of electronic products.

Earnings of individual production workers may differ from the averages shown above, since such earnings depend not only on the type of plant in which they work but also on factors such as skill level and experience, length of service, geographic location, and amount of overtime.

Electronics workers generally receive premium pay for overtime work and for work on Sundays and holidays. Virtually all plants provide

Type of product	*Average hourly earnings*	*Average weekly earnings*
All manufacturing industries	$3.36	$133.73
Major electronics manufacturing industries:		
Government and industrial electronics end products	3.68	149.78
Radio and television receiving sets, and phonographs	3.19	126.64
Electron tubes	2.96	113.96
Semiconductors and other components, except tubes	2.80	108.36

extra pay for evening and night shift work.

Many workers in electronics manufacturing plants receive 2 or 3 weeks' vacation with pay, depending on their length of service, and from 6 to 8 paid holidays a year. Almost all electronics workers are covered by health and life insurance plans; many are covered by pension plans and other fringe benefits.

Working conditions in electronics manufacturing compare favorably with those in other industries. Plants are usually well lighted, clean, and quiet. Many plants are relatively new and are located in suburban and semirural areas. Most plant departments are air conditioned where dust-free conditions or air temperature control is necessary for the manufacture of certain types of electronic equipment. The work in most electronics occupations is not strenuous. Many assembly line operations are repetitious. Music during working hours, cafeterias, recreational facilities, and social programs are provided for employees by some electronics manufacturing firms.

The frequency of injuries in electronics manufacturing is far below the average in manufacturing as a whole, and injuries are usually less severe.

Many workers in electronics manufacturing are covered by labor-management agreements. The principal unions involved are the International Union of Electrical, Radio and Machine Workers; International Brotherhood of Electrical Workers; International Association of Machinists and Aerospace Workers; and the United Electrical, Radio and Machine Workers of America (Ind.).

Sources of Additional Information

Further information concerning careers in electronics manufacturing can be obtained from the public relations departments of electronics manufacturing companies and from:

Electronic Industries Association,
2001 Eye St. NW., Washington,
D.C. 20006.

OCCUPATIONS IN FOUNDRIES

Metal castings produced by foundry workers are essential for thousands of products ranging from automobile engines to cooking utensils. In early 1970, 450,000 workers were employed in foundries and foundry departments of other metalworking establishments.

Casting is a method of forming metal into intricate shapes. To cast metal, a mold is prepared with a cavity in it that has been shaped by a pattern or model of the object to be cast. Metal is then melted and poured into the mold cavity, where it cools and solidifies.

Castings may range from a fraction of an inch to many feet and weigh from less than an ounce to many tons. The strength and rigidity of cast objects makes casting suitable for thousands of household and industrial items, including automobile parts, plumbing fixtures, machine tools, dies, railroad car wheels, and aircraft and missile components.

Nature and Location of Foundry Work

More than two-thirds of the 450,000 foundry workers in 1970 were employed in independent foundries that sell their castings to other firms. Most of the remainder were employed in the foundries of plants that use castings in their final products, such as automobile and industrial machinery plants. A small proportion of foundry workers were employed in foundry pattern shops of various metalworking plants and in shops that make patterns on order.

Foundries usually specialize in a particular alloy since somewhat different methods and equipment are used to melt and cast various metals. Some foundries cast ferrous metals, such as steel or gray iron. Others cast nonferrous metals, such as aluminum, brass, or zinc. However, many nonferrous foundries and some ferrous foundries cast several metals.

There are six principal methods of casting, each named for the type of mold used. In the most common method, green-sand molding, sand composed chiefly of silica, clay, and moisture is packed in a boxlike container, called a flask, around a pattern. After the pattern is withdrawn, molten metal is poured into the mold cavity to form the desired metal shape. Sand molds can be used only once, but the sand is usually reconditioned and reused.

A second method, called permanent molding, employs a metal instead of a sand mold. Metal molds, which can be used many times, are chiefly for casting nonferrous products. However, some ferrous castings are also produced by this method.

Precision investment casting, a third method (often known as the "lost wax" process), uses ceramic molds. In this method, a wax or plastic pattern is coated with refractory clay. After the coating hardens, the pattern is melted and drained, so that a mold cavity is left into which molten metal is poured. Castings produced from these molds are precise and require little machining.

Shell molding, a fourth process, is becoming increasingly important. In this method, a heated metal pattern is covered with sand coated with resin. The sand forms a thin shell mold that, after curing, is stripped from the pattern. Castings produced from these molds are precise and have a smooth surface. The process is even used more widely to make cores, which form designed cavities in the castings.

Die casting, a fifth process, is done entirely by machines operated by die-casting machine operators. In this method, molten metal under high pressure is forced into dies from which the castings are later automatically ejected, or removed by hand, when the metal solidifies.

A sixth method, centrifugal casting, permits production of pipe cylinders and rolls having cylindrical cavities. Molten metal is poured into a spinning mold where centrifugal force distributes the metal against the cavity.

Most foundries are small. More than 90 percent employ fewer than 250 workers each. However, about one-third of all foundry workers are in establishments which employ 500 workers or more.

Small foundries generally produce small amounts of different kinds of castings for nearby metal fabricating plants. They employ hand and machine molders and coremakers (the key foundry occupations), and a substantial number of unskilled laborers. Many of these foundries produce large castings, and require the skills of floor molders.

Large foundries are often highly mechanized and produce great quantities of identical castings. These shops employ relatively few unskilled laborers because cranes, conveyors, and other types of equipment are used in place of hand labor to move materials, molds, and castings. However, proportionately greater numbers of skilled maintenance workers, such as millwrights and electricians, are employed in these foundries to service and repair the large amount of machinery and equipment. Also, these shops employ proportionately fewer skilled molders and coremakers.

There are foundry jobs in every State and in most large- and medium-size cities in the country. Because foundries usually are located near plants where their castings are used, foundry jobs tend to be concentrated in States where there is considerable metalworking activity; for example, in Michigan, Ohio, Pennsylvania, Illinois, Indiana, and Wisconsin.

Foundry Occupations

More than four-fifths of the approximately 450,000 workers in foundries and foundry departments in early 1970 were employed in plant occupations. More than half of the plant workers were employed in occupations not found in other industries. To illustrate more clearly the duties of these workers, a brief description of the jobs involved in the most common casting process—sand casting—follows:

After the casting is designed, the *patternmaker* makes a wood or metal pattern in the shape of the casting desired. Next, a *hand molder* (D.O.T. 518.381) makes sand molds by packing and ramming sand, specially prepared by a *sand mixer* (D.O.T. 579.782), around the pattern. A *molder's helper* (D.O.T. 519.887) may assist in these operations. If large numbers of identical castings are to be made, molding machines may be used to make the molds at a faster speed than is possible by hand. The operator of this equipment is called a *machine molder*.

A coremaker shapes sand, specially prepared by a *sand mixer*, into cores (bodies of sand designed usually to create hollow spaces in castings). Most cores are baked in an oven by a *core-oven tender* (D.O.T. 518.885). Core parts or sections are put together by a *core assembler* (D.O.T. 518.887). After the cores are assembled, they are placed in the molds by *coresetters* (D.O.T. 518.884) or molders. Now, the molds are ready for the molten metal to be poured.

A *furnace operator*, or *melter* (D.O.T. 512.782) operates the furnace that melts the metal. The metal is usually poured into molds by a *pourer* (D.O.T. 514.884), although in some small foundries molders may perform this task. When the castings have solidified, they are dumped from the molds by a *shakeout man* (D.O.T. 519.887) and sent to the cleaning and finishing department.

Dirty and rough surfaces of castings are cleaned and smoothed by blasting or tumbling, and chipping and grinding. A *shotblaster* (D.O.T. 503.887) operates a machine that cleans the castings by blasting them with air mixed with metal shot or grit. The castings may be smoothed by tumbling. In this process, the castings together with an abrasive material, and sometimes water, are placed in a barrel which is rotated. As the barrel turns, the castings tumble against each other, thereby removing sand, burrs, and scale. The man who controls the barrel is called a *tumbler operator* (D.O.T. 599.885). Sandblasters and tumbler operators may also operate a machine which both tumbles and blasts the castings. A *chipper* (D.O.T. 809.884) and a *grinder* (D.O.T. 809.884) use pneumatic chisels, powered abrasive wheels, powersaws, and handtools, such as hammers, chisels, and files, to remove excess metal and to finish the castings.

Castings are frequently heat treated in furnaces to improve the mechanical properties of the metal; a *heat treater*, or *annealer* (D.O.T. 504.782), operates these furnaces. Before the castings are packed for shipment, a *casting inspector* (D.O.T. 514.687) checks them to make sure they are structurally sound and meet blue-print specifications.

Many foundry workers are employed in occupations that are common to other industries. For example, foundry maintenance mechanics, machinists, carpenters, and millwrights maintain and repair plant equipment. Crane and derrick operators and truckdrivers move castings and casting materials from place to place. Machine tool operators finish castings in the many foundries that do machine finishing work. Foundries also employ thousands of workers in unskilled jobs, such as guard, janitor, and laborer.

Nearly a fifth of all foundry workers are employed in professional, technical, administrative, clerical, and sales occupations. Of these personnel, the largest number are clerical workers, such as secretaries, stenographers, typists, and accounting clerks.

Foundries also employ substantial numbers of professional and technical workers, such as engineers, and metallurgists. Some of these employees do research; others make designs and layouts of machinery and equipment; control the quality of castings; or supervise plant operations and maintenance. In recent years, increasing numbers of these workers have been hired to sell castings and to assist customers in designing cast parts. Foundry technicians are employed in a variety of functions concerning the control of quality in casting production. For example, they may test molding and coremaking sand, make chemical analyses of metal, and operate machines that test the strength and hardness of castings. In this work they may use X-ray, magnetic, or sound apparatus to inspect the internal structure of castings.

Administrative workers employed in foundries include office managers, personnel workers, purchasing agents, plant managers, and other supervisory workers.

The foundry work force is predominately male, since much of the work connected with the production of castings is strenuous. Women are employed primarily in office jobs, although some are employed in production occupations such as coremaker. Women also assemble wax and plastic patterns in investment casting foundries.

Detailed discussions of three principal foundry occupations—patternmakers, coremakers, and molders—follow this chapter. (Detailed discussions of professional, technical, mechanical, office, and other occupations found in foundries as well as in many other industries are given in the sections of the *Handbook* covering individual occupations.)

Training, Other Qualifications, and Advancement

Most foundry plant workers start in unskilled jobs, such as laborer or helper. A worker may begin as a laborer and, after receiving informal on-the-job training from a foreman or experienced worker, he may gradually learn how to perform the more skilled jobs. This is the usual practice in training workers for such casting process jobs as melter, chipper, and grinder.

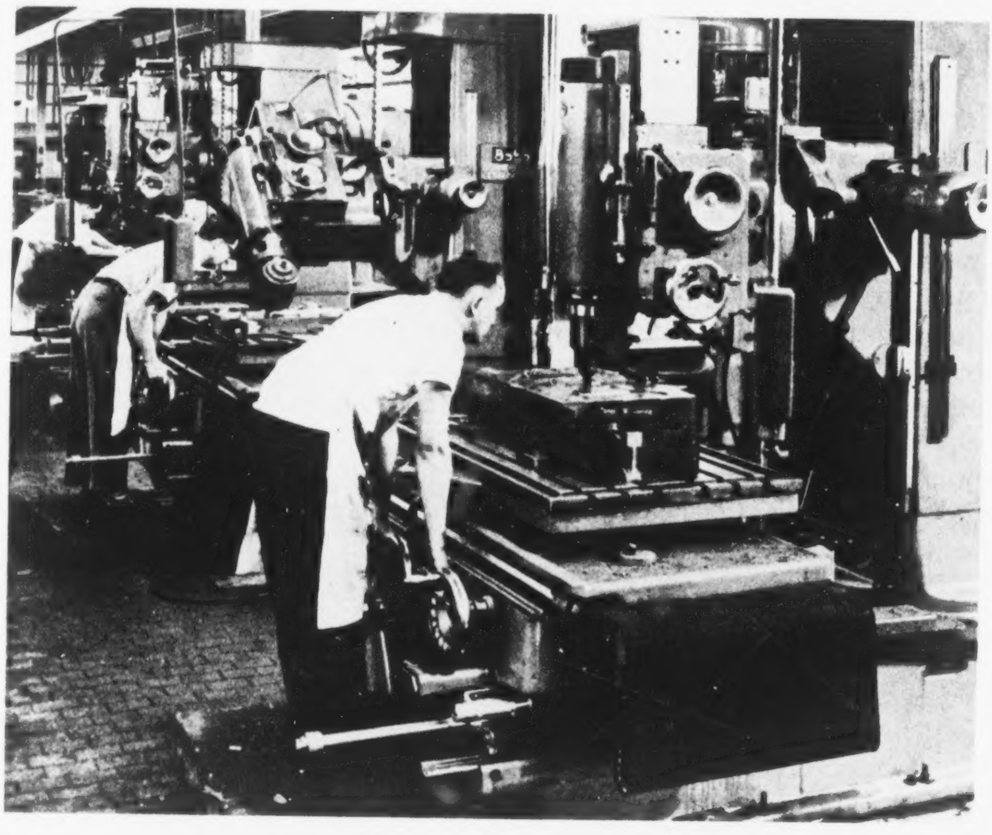
Some skilled foundry workers—particularly hand molders, hand coremakers, and patternmakers—learn their jobs through formal apprenticeship. In this type of training, the young worker is given supervised on-the-job training for a period of 4 or 5 years, usually supplemented by classroom instruction. A worker who has completed an apprenticeship program is usually preferred by foundry management because he has a greater working knowledge of all foundry operations and is, therefore, better qualified to fill supervisory jobs.

An increasing number of skilled foundry workers learn their jobs through a combination of trade school and on-the-job training. Beginning workers may attend trade schools that offer training in foundry work before entering a formal apprenticeship program; in some cases, trade school courses may be credited toward completion of formal apprenticeships. Training programs for updating and upgrading the knowledge and skills of experienced workers are conducted by some foundries and by the American Foundry Society Training and Research Institute.

Employment Outlook

Employment in foundries is expected to show little or no change through the 1970's, despite an anticipated substantial increase in the production of metal castings. Nevertheless, thousands of job openings will become available each year because of the need to replace experienced workers who retire, die, or transfer to other fields of work.

The growing population and rising levels of personal income will result in a greater demand for castings and products that have cast parts. Examples of these products are automobiles, household appliances, plumbing fixtures, and gas and water lines. In addition, new industrial machinery and transportation equipment, much of which will



be made of cast components, will be needed to produce and distribute goods for the growing population. However, laborsaving technological developments are expected to enable foundries to make more castings without increasing employment significantly. For example, continued improvements in production methods, particularly in machine molding and coremaking, and increasing use of machinery for materials handling will result in greater output per worker.

Although foundry employment as a whole is not expected to change significantly through the 1970's, employment will rise in some occupations. For example, scientists, engineers, and other technical personnel are expected to increase as a result of expanding research and development activities. Technicians also will be needed in greater numbers as foundries introduce improved quality control procedures and new production techniques. More maintenance workers and operators of materials moving machines will be required because of the increasing use of materials-handling equipment and more complex processing equipment. In contrast, the number of hand molders, hand coremakers, and other hand processing workers is expected to show little change, because of the increasing substitution of machine molding and coremaking for hand processes. The number of laborers and other unskilled workers will continue to decline.

Earnings and Working Conditions

Foundry production workers have higher average hourly earnings than production workers in manufacturing as a whole. In 1970, earnings of production workers in iron and steel foundries averaged $151.44 a week, or $3.73 an hour. In nonferrous foundries, the average was $138.55 a week, or $3.49 an hour. By comparison, production workers in all manufacturing industries had average earnings of $133.73 a week, or $3.36 an hour.

Collective bargaining contracts negotiated between foundry employers and unions generally included provisions for fringe benefits, such as holiday pay, vacation pay, and retirement pensions. Other important benefits often included in such contracts were life, medical, and accident insurance.

Working conditions in foundries have improved in recent years. Many foundries, through the installation of modern ventilating systems, new equipment, and improved plant layout, have reduced heat, fumes, and smoke. Although the rate of disabling work injuries in foundries is higher than the average for all manufacturing industries, employers and unions attempt to eliminate injuries by promoting safety training and by using protective equipment, such as face shields, metal toe shoes, helmets, and safety glasses.

Various labor unions have foundry workers in their membership. Among these unions are the International Molders' and Allied Workers' Union; the United Steelworkers of America; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; and the International Union of Electrical, Radio and Machine Workers. Many patternmakers are members of the Pattern Makers' League of North America.

Sources of Additional Information

For further information about work and/or training opportunities in foundry occupations, inquiries should be directed to local foundries; the local office of the State employment service; the nearest office of the State apprenticeship agency or the Bureau of Apprenticeship and Training, U.S. Department of Labor; and the following organizations:

American Foundrymen's Society, Golf and Wolf Rds., Des Plaines, Ill. 60016.

Foundry Educational Foundation, 1138 Terminal Tower, Cleveland, Ohio 44113.

Gray and Ductile Iron Founders' Society, Inc., 930 National City–East 6th Bldg., Cleveland, Ohio 44114.

International Molders' and Allied Workers' Union, 1225 East McMillan St., Cincinnati, Ohio 45206.

Malleable Founders' Society, 781 Union Commerce Bldg., Cleveland, Ohio 44115.

National Foundry Association, 9838 Roosevelt Road, P.O. Box 76, Westchester, Ill. 60156.

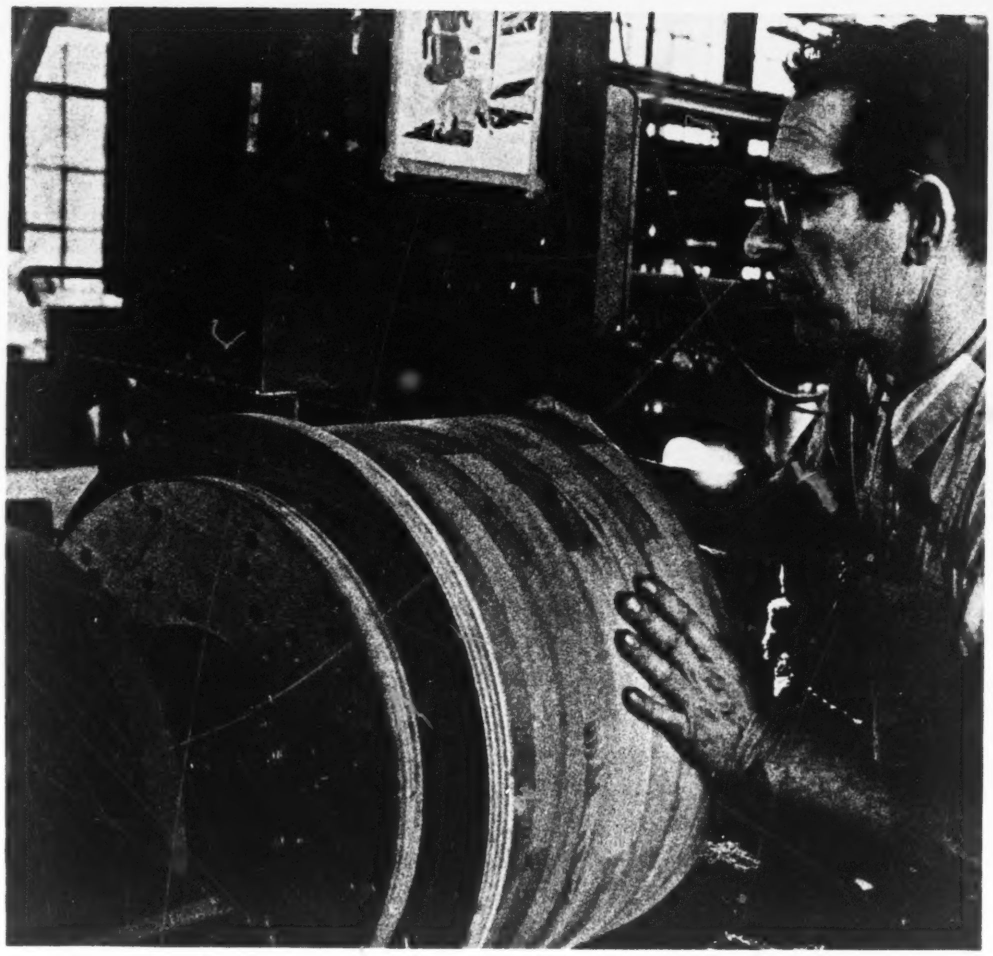
Non-Ferrous Founders' Society, Inc., 21010 Center Ridge Rd., Cleveland, Ohio 44116.

Steel Founders' Society of America, Westview Towers, 21010 Center Ridge Rd., Cleveland, Ohio 44116.

PATTERNMAKERS

Nature of the Work

Foundry patternmakers are highly skilled craftsmen who build patterns used in making molds in which metal castings are formed. Most of the workers in the occupation are *metal patternmakers* (D.O.T. 600.280); a somewhat smaller number are *wood patternmakers* (D.O.T. 661.281). A grow-



ing number of patternmakers work with both metal and wood. In the last decade or so, increasing use has been made of plaster and plastics in patternmaking. A small number of patternmakers work exclusively with plaster and plastics. However, these materials also are used by some metal and wood patternmakers.

Patternmakers work from blueprints prepared by the engineering department or the customer's design engineer. They make a precise pattern for the product, allowing for shrinkage of molten metal used in the casting process and for other factors.

The metal patternmaker prepares patterns from metal stock or from rough castings made from an original wood pattern. To shape and finish the patterns, he uses a variety of metal-working machines, including the engine lathe, drill press, shaper, milling machine, power hacksaw, and grinder, as well as small handtools.

The wood patternmaker selects the appropriate woodstock, lays out the pattern, marks the design for each section on the proper piece of wood, and saws each piece roughly to size. He then shapes the rough pieces into final form, using various woodworking machines, such as circular saws, lathes, planers, bandsaws, and sanders, as well as many small handtools. Finally, he assembles the pattern segments by hand, using glue, screws, and nails. Standardized colors are used to finish the pattern.

A high degree of accuracy is required to make patterns, since any imperfection in the pattern will be reproduced in the castings made from it. Throughout his work, the patternmaker carefully checks each dimension of the pattern, using a variety of measuring instruments such as shrink rules, calipers, micrometers, and gauges. He also makes core boxes (in much the same manner as patterns are constructed) and repairs patterns and core boxes.

More than half of the patternmakers work in foundry pattern shops of plants making products such as machinery, transportation equipment, and fabricated metal products. Other patternmakers work in plants that make patterns on order, or in pattern shops in independent foundries.

Training, Other Qualifications, and Advancement

Apprenticeship is the principal means of qualifying as a journeyman patternmaker. Because of the high degree of skill and the wide range of knowledge needed for patternmaking, it is difficult to learn the trade informally on the job. In some instances, skilled machinists have been able to transfer to metal patternmaking with additional on-the-job training or experience. Trade school courses in patternmaking provide useful preparation for the prospective apprentice. Such courses may be credited toward completion of the apprenticeship period. However, these courses do not substitute for apprenticeship or other on-the-job training.

The usual apprenticeship period for patternmaking is 5 years. At least 144 hours of classroom instruction in related technical subjects are normally provided annually. There are separate apprenticeship programs for wood and metal patternmaking.

The apprentice patternmaker begins by helping journeymen in routine duties. He makes simple patterns under close supervision. As he progresses, the work becomes increasingly complex and the supervision more general.

Patternmaking, although not strenuous, requires considerable standing and moving about. Manual dexterity is especially important because of the precise nature of the work. The ability to visualize objects in three dimensions is also important. Employers generally require patternmaker apprentices to have at least a high school education.

Employment Outlook

Employment of foundry patternmakers—who numbered about 20,000 in early 1970—is expected to show little or no change through the 1970's, despite the anticipated substantial increase in foundry production. Nevertheless, several hundred job openings will arise each year because of the need to replace experienced patternmakers who retire, die, or transfer to other occupations. Most of these openings will be for metal patternmakers.

The need for patternmakers will not keep pace with increases in the production of castings, because of the greater use of metal patterns. These patterns can be used many times to make identical molds, thereby reducing the number of individual patterns needed to produce castings.

Because patternmakers learn either basic metalworking or woodworking, they are prepared for employment in related fields when patternmaking employment is not available. Wood patternmakers can qualify for woodworking jobs, such as cabinetmaker, and metal patternmakers can transfer their skills to machining occupations such as machinist or layout man.

Earnings and Working Conditions

Patternmakers generally have higher earnings than other skilled foundry workers. However, earnings depend on skill requirements of the job, type of metal poured, geographic location, and other factors. In January 1970, average (median) straight-time hourly earnings of wood patternmakers ranged from $3.95 in steel foundries to $4.50 in gray iron and malleable iron foundries, according to a survey of wages and fringe benefits in 52 labor areas, made by the National Foundry Association. Generally, metal patternmakers have higher earnings than wood patternmakers.

See "Sources of Additional Information" in the introductory section of this chapter.

MOLDERS

Nature of the Work

The *molder* prepares a mold which contains a hollow space in the shape of the item to be made. The mold is made by packing and ramming specially prepared sand around a pattern—a model of the object to be duplicated—in a box called a flask. A flask is usually made in two parts which can be separated to allow removal of the pattern without damaging the mold cavity. Molten metal is poured into the cavity which, when solidified, forms the casting. A molder uses pneumatic-powered rammers and handtools, such as trowels, shovels, and mallets, to handle, compact, and smooth the sand in molds made by hand.

Most of the more than 55,000 workers in this occupation in early 1970 were machine molders; the rest were hand—bench and floor—molders. *Machine molders* (D.O.T. 518.782) operate machines which simplify and speed the making of large quantities of identical sand molds. Machine molders assemble the flask and pattern on the machine table, fill the flask with prepared sand, and operate the machine by use of control levers and pedals. Many machine molders set up and adjust their own machines. Some semiskilled workers operate machines already set up by more experienced molders or maintenance men.

Bench and floor molders use mainly hand methods to make the sand molds. Power tools, such as pneumatic hammers, and handtools, such as trowels and mallets, are used to smooth the sand. Molds for small castings are usually made on

the workbench by *bench molders* (D.O.T. 518.381); those for large and bulky castings are made on the foundry floor by *floor molders* (D.O.T. 518.381). Skills required vary. An all-round hand molder makes many different kinds of molds. A less skilled molder does more repetitive work and specializes in a few simple types of molds.

Training, Other Qualifications, and Advancement

Completion of a 4-year apprentice training program, or equivalent experience, is needed to become a journeyman molder and thus qualify both for all-round hand molding and for the specialized skilled or supervisory jobs. Men with this training are also preferred for some kinds of machine molding.

The apprentice works under the close supervision of journeymen. About half of the apprentice training is devoted directly to molding. The apprentice begins with a simple job, such as shoveling sand; and gradually takes on more difficult and responsible work, such as ramming molds, withdrawing patterns, and setting cores. He also learns to operate the various types of molding machines. As his training progresses, he makes complete molds, beginning with simple shapes and progressing to those of increasing complexity. This training includes both floorwork and benchwork. In addition, the apprentice may work in other foundry departments to develop all-round knowledge of foundry methods and practices. The apprentice usually receives at least 144 hours of classroom instruction each year in such subjects as shop arithmetic, metallurgy, and shop drawing.

Molders' helpers and less-skilled hand molders frequently learn molding skills informally on the job. However, this way of learning the trade takes longer and is less reliable than apprenticeship.

Hand molders who do highly repetitive work usually learn their jobs during a brief training period. "Learners" (either men without previous foundry experience or upgraded foundry helpers) work with a molder to make a particular kind of mold. After 2 to 6 months, the learner is usually competent to make the same or a similar mold, without close supervision.

The more difficult and responsible types of machine molding jobs also require formal or equivalent training. However, most machine molding jobs can be learned in 60 to 90 days of on-the-job training.

An eighth grade education usually is the minimum requirement for apprenticeship. Many employers, however, require additional education up to and including high school graduation for apprenticeship in skilled hand molding or machine molding jobs.

Physical standards for molding jobs are fairly high. Hand and floor molders stand at their work, move about a great deal, and do frequent lifting. Hand molders need a high degree of manual dexterity and good vision. Since molding work is strenuous, few women are employed.

Employment Outlook

Employment of molders is expected to show little or no change through the 1970's, despite the anticipated substantial increase in foundry production. The demand for molders will not keep pace with the increase in production, since the trend is toward more machine molding and less hand molding, and the increasing use of permanent molds and shell molds. Nevertheless, the need to replace experienced molders who retire, die, or transfer to other occupations will provide more than 1,000 job openings each year. Several hundred of these openings will be for molding apprentices. Openings also will occur for workers in entry jobs in machine molding and in less skilled types of hand molding.

Earnings and Working Conditions

Earnings of molders depend on several factors, including type of molding work—hand or machine; skill requirements of the job; type of metal poured; and geographic location. In January 1970, the average (median) straight-time hourly earnings of floor molders was \$3.55; bench molders, \$3.45; squeezer machine molders, \$3.35; and heavy machine molders, \$3.35, according to a survey of wages and fringe benefits in 52 labor areas, made by the National Foundry Association. As shown in the following tabulation, floor molders in steel foundries received the highest average (median) straight-time hourly earnings.

Type of molder	*Type of foundry*		
	Gray iron and malleable	*Steel*	*Non-ferrous*
Floor	\$3.55	\$3.65	\$3.55
Bench	3.45	3.45	3.25
Heavy machine	3.35	3.35	3.45
Squeezer machine	3.35	3.25	3.35

See "Sources of Additional Information" in the introductory section of this chapter.

COREMAKERS

Nature of the Work

Coremakers prepare the "cores" which are placed in molds to form the hollow sections or holes usually required in metal castings. The poured metal solidifies around the core so that when the core is removed, the desired cavity or contour remains. A core may be made either by hand or machine. In both instances, prepared sand is packed into a core box, a block of wood or metal into which a hollow space of the size and shape of the desired core has been cut. After the core has been removed from the box, it is hardened either by baking or by other drying methods. When hand methods are used to make a core, the coremaker uses mallets and other handtools to pack and ram sand into the core box.

In hand coremaking, small cores are made on the workbench by *bench coremakers* (D.O.T. 518.381) and bulky cores are made on the foundry floor by *floor coremakers* (D.O.T. 518.381). There is a wide range of skill requirements in hand coremaking. All-round hand coremakers (journeymen) prepare large and intricate cores. The less skilled coremakers make smaller and simpler cores. Their work is highly repetitive because they frequently produce large quantities of identical cores. Many skilled coremakers are employed as supervisors.

Machine coremakers (D.O.T. 518.885) operate machines which make sand cores by forcing sand into specially shaped hollow forms. Most machine made cores are blown by compressed air. Some machine coremakers are required to set up and adjust their machines and do finishing operations on the cores. Other coremakers are primarily machine tenders. They are closely supervised and their machines are adjusted for them.

Training, Other Qualifications, and Advancement

Completion of a 4-year apprentice training program or the equivalent in experience is needed to become a skilled hand coremaker. Coremaking apprenticeships are also sometimes required for the more difficult machine coremaking jobs. Only a brief period of on-the-job training is needed for less skilled hand coremaking and for most machine coremaking jobs. Training in coremaking and molding are often combined in a single apprenticeship.

The apprentice works with journeymen coremakers in routine duties and then in more advanced work such as making simple cores and operating ovens. As his skill increases, the apprentice makes more complex cores. He acquires experience in benchwork and floorwork and in the operation of coremaking machines. Classroom instruction covering subjects such as arithmetic and the properties of metals, generally supplement on-the-job training. Hand coremakers who have all-round training may be promoted to supervisor.

An eighth grade education is usually the minimum required for coremaking apprentice training; some employers require graduation from high school. For the less skilled coremaking jobs, persons without previous experience may be hired, or foundry laborers or helpers may be upgraded. Some types of hand coremaking require a high degree of manual dexterity. Light coremaking is not very strenuous, and women are frequently employed.

Employment Outlook

Employment of coremakers—who numbered about 25,000 in early 1970—is expected to show little or no change through the 1970's, despite the anticipated substantial increase in foundry production. The demand for coremakers will not keep pace with the increase in production, because of the growing use of machine-made rather than hand-made cores. Nevertheless, several hundred job openings will arise each year because of the need to replace experienced coremakers who retire, die, or transfer to other occupations.

Earnings and Working Conditions

Earnings of coremakers depend on skill requirements of the job, type of metal poured, geographic location, and other factors. In January 1970, the average (median) straight-time hourly earnings of floor coremakers was $3.55; bench coremakers, $3.35; and machine coremakers, $3.25, according to a survey of wages and fringe benefits in 52 labor areas, made by the National Foundry Association. As shown in the following tabulation, the highest average (median) straight-time hourly earnings were received by floor coremakers in steel foundries:

Occupation	*Type of foundry* *Gray iron and malleable*	*Steel*	*Non-ferrous*
Floor coremaker	$3.42	$3.65	$3.35
Bench coremaker	3.35	3.25	3.25
Machine coremaker	3.25	3.55	3.05

See "Sources of Additional Information" in the introductory section of this chapter.

OCCUPATIONS IN THE INDUSTRIAL CHEMICALS INDUSTRY

The industrial chemical industry has grown in just a few decades into one of the great manufacturing industries of our Nation. An important reason for this growth has been the industry's huge expenditures for research and development which have provided many new and improved products for its customers—mainly manufacturing industries. A wide variety of industrial chemical products contribute to our everyday needs; for example, synthetic fibers for clothing and rugs, and plastics for automobiles and furniture. Chemical products also are essential for the manufacturing of missile and space equipment, rocket propulsion fuels, and other defense and space materials.

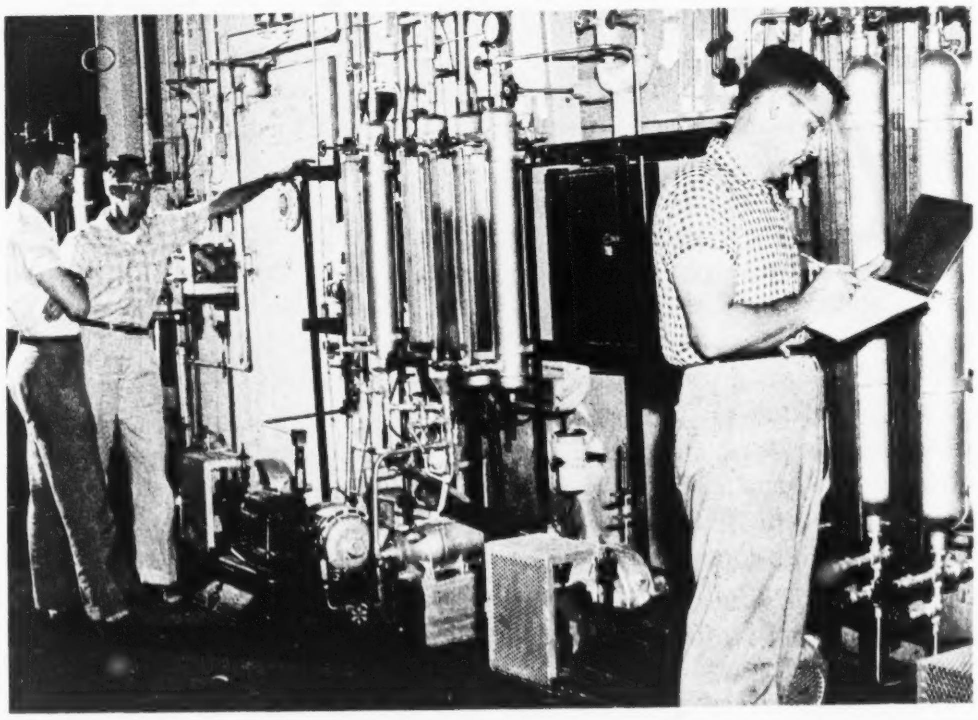
In 1970, nearly 545,000 wage and salary workers were employed in the industrial chemical industry in a wide range of occupations. Job requirements varied from graduate college degrees for some scientists and engineers to a few days of on-the-job training for some plant workers.

Nature of the Industry

The industrial chemical industry (SIC 281 and 282) is made up of plants which manufacture industrial inorganic and organic chemicals, plastic materials and synthetic resins, synthetic rubber and synthetic and other man-made fibers, except glass. These chemicals are used mainly by other companies in the chemical industry, and by other manufacturing industries as raw materials or as processing agents. Other chemical products such as drugs and detergents, which are sold directly to the consumer without further processing, are not discussed in this statement.

Industrial chemical plants make organic chemicals from fossil materials such as coal and petroleum, or from living materials such as agricultural and forest products. Some products of organic chemicals, such as synthetic fibers and plastics, are well known. Among those less known are coal tar crudes, benzene, and acetone. The principal users of organic chemicals are textile, plastics products, rubber, and food-processing industries. Inorganic chemicals come from nonliving matter; for example, sulfur and mineral ores. They are basic materials for making other chemicals as well as finished products such as paper and gasoline. In at least one respect, the manufacture of chemicals differs from the manufacture of most other products—the ingredients used to make chemicals undergo reactions which produce compounds vastly different in nature and appearance from the raw materials. For example, nylon is produced from coal, air, and water.

A modern chemical plant is made up of huge towers, tanks, and buildings linked together by a network of pipes. These structures contain the various types of processing equipment. Raw materials go through several operations including dissolving, heating, cooling, mixing, evaporating, filtering, and drying. Between each operation the materials, which may be liquid, solid, or gas, are transported by pipes or conveyors. Throughout these operations, automatic control devices regulate the flow of materials, the combination of chemicals, and the temperature, pressure, and time for each operation. These controls make possible the processing of tons of material in one continuous operation with little manual handling.



Operator monitors control of autoclave.

Approximately 3,000 plants in the United States make industrial chemicals. About two-thirds of them have fewer than 50 employees. However, more than one-half of the industry's workers are employed in plants that have 500 or more workers. Chemical plants are usually located on the outskirts of industrial centers. Sometimes plants are built near the sources of raw material; for example, plants which produce chemicals made from petroleum and natural gas are located near the oilfields and refineries of Texas, California, and Louisiana.

Although industrial chemical workers are employed in most States, more than 65 percent of them and nearly 40 percent of the plants are in the following 10 States: New Jersey, Texas, Tennessee, New York, Pennsylvania, Virginia, Delaware, Ohio, Michigan, and West Virginia.

Occupations in the Industry

Industrial chemical firms employ workers with many different levels of skill and education. About 3 out of every 5 employees are engaged in processing, maintenance, or other plant-related activities. A large number of scientists, engineers, and other technical personnel also are employed because of the highly technical nature of chemical products and the methods of production. Administrative and professional employees, including salesmen, accountants, lawyers, and personnel officers, make up another sizeable segment of the industry's work force. In addition, large numbers of bookkeepers, typists, office machine operators, and other clerical workers are employed.

About 1 out of every 8 workers in the industrial chemical industry is a woman. Most women in this industry work in clerical jobs, although some work in chemical laboratories as research chemists or as laboratory technicians and assistants. In a few industrial chemical plants, women are employed as chemical operators or as packers.

Plant Occupations. Plant workers, who represent 3 out of every 5 employees in the industrial chemical industry, generally can be divided into three major occupational groups: processing workers, maintenance workers, and other plant workers.

Process equipment operators and their helpers are the largest occupational group. Many of these operators are highly skilled. *Chemical operators* (D.O.T. 558.885 and 559.782) control the various pieces of equipment which convert raw materials into chemical products. Operators set dials on devices that measure the exact amount of materials to be processed and control temperature, pressure, and flow of materials. They keep a record of operations and report any sign of equipment breakdown. They use instruments to measure and test chemicals, or they may send samples of chemicals to laboratory technicians in the testing laboratory. They may be assisted by chemical operators of less skill and by helpers. Sometimes chemical operators are classified according to the type of equipment they operate, such as filterer or mixer.

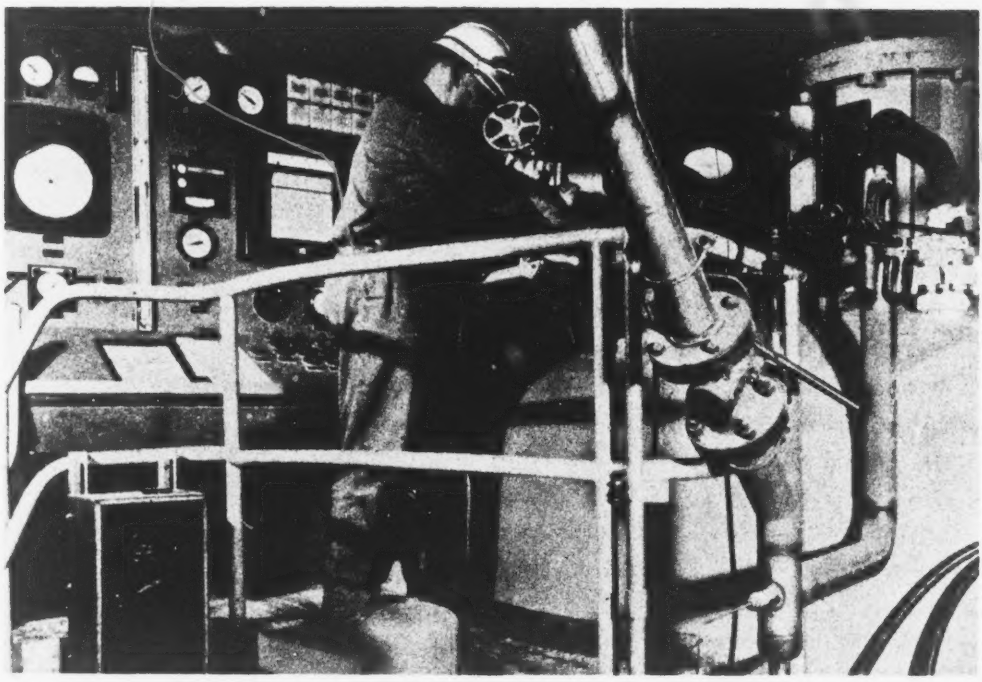
The industry employs many skilled maintenance workers to prevent interruptions of highly automated production processes. Maintenance is very important because of the extremes of temperature, pressure, and corrosion to which pipes, vats, and other plant equipment are subjected. Included among maintenance workers are *pipefitters,* who lay out, install, and repair piping; *maintenance machinists,* who make and repair metal parts for machines and other equipment; *electricians,* who maintain and repair wiring, motors, and other electrical equipment; and *instrument repairmen,* who install and repair instruments and control devices. In some chemical plants one worker may do several maintenance jobs.

Plant workers who do not operate or maintain equipment may do many other jobs. Some drive trucks; some load and unload materials on trucks, railroad cars, or ships; and other workers keep inventory of stock and tools. The industry also employs custodial workers.

Scientific and Technical Occupations. The industrial chemical industry is one of the Nation's largest employers of scientific and technical personnel. About 1 out of every 6 employees is a scientist, engineer, or technician. About 40 percent work in laboratories to develop new products and new methods of production, and to do basic research. Most of the remainder are in plant operations. Some scientists and technicians are in administrative or sales positions requiring technical backgrounds.

Chemists and chemical engineers make up the largest proportion of scientific and technical personnel. Many *chemists* work in research and development. A large number in production departments analyze and test chemicals for quality control during processing. Some chemists supervise plant workers; others are salesmen, writers, or administrators who must have technical knowledge.

Chemical engineers apply their knowledge of both chemistry and



Operator monitors control of autoclave.

engineering to the design, construction, operation, and improvement of chemical equipment and plants. They convert processes developed in laboratories into large-scale production methods. Some chemical engineers are employed in production departments and others are in selling, customer service, market research, and writing jobs.

Mechanical engineers design and lay out power and heating equipment such as steam turbines. They often supervise the installation, operation, and maintenance of chemical processing equipment. *Electrical engineers* design and develop electrical and electronic equipment, such as control devices and instruments, and facilities for generating and distributing electric power.

The industry employs many technical assistants such as laboratory technicians and draftsmen. *Laboratory technicians* assist chemists and engineers in research and development and quality control. Depending on their training and experience, they may run simple tests or do highly technical analyses. They may record the results of their work in reports and charts for chemists and chemical engineers.

Administrative, Clerical and Related Occupations. About 1 out of every 4 employees in the industry is an administrator, clerk, or other white-collar worker. Many high-level administrative and management positions are filled by chemists and chemical engineers. At the top of the administrative group are executives who make policy decisions about finance, products to be manufactured, and plant locations. Making such decisions requires the help of a large body of specialists, including accountants, sales representatives, lawyers, and personnel in industrial relations, advertising, and market research. Other workers assist these specialists. For example, clerical employees keep records on personnel, payroll, raw materials, sales, shipments, and maintenance.

(Detailed discussions of professional, technical, mechanical, and other occupations found in the industrial chemical industry and other industries are given elsewhere in this *Handbook* in the sections covering the individual occupations. See index for page numbers.)

Training, Other Qualifications, and Advancement

The industrial chemical industry generally hires and trains inexperienced workers for processing and maintenance jobs. Companies prefer to hire high school graduates.

In many plants, a new worker is sent to a labor pool for assignment to jobs such as filling barrels and moving materials. When a vacancy occurs, he may be transferred to one of the processing departments. As he gains experience, he moves to more skilled jobs. Thus, he may advance from laborer to chemical operator helper, to assistant chemical operator, and then to skilled chemical operator. Skilled processing workers are rarely recruited from other plants.

Many companies have maintenance training programs which last from a few months to several years and include classroom instruction. Many companies encourage skilled maintenance workers and trainees to enroll in correspondence courses or take job-related courses at vocational schools and technical institutes. After successfully completing these courses, workers are reimbursed for part or all of their tuition.

A bachelor's degree in engineering, chemistry, or another science is the minimum educational requirement for scientists and engineers. For research jobs, applicants with advanced degrees are generally preferred. Some firms have formal training programs for young college graduates with engineering or scientific backgrounds. Before being assigned to a particular department, these employees work in various parts of the plant for brief periods to gain a broad knowledge of chemical manufacturing operations. Other firms immediately assign junior chemists or engineers to a specific activity such as research or sales. Some firms sponsor advanced academic training through tuition-refund programs.

Technicians qualify for their jobs in many ways. Graduates of technical institutes and junior colleges are preferred. Many workers qualify through on-the-job training and experience. Sometimes trainees are sent to a technical institute at company expense. Students who have not completed all requirements for a college degree, especially those who have received some education in mathematics, science, or engineering, often are employed as technicians.

Laboratory technicians begin as assistants and advance to jobs of greater responsibility. Inexperienced draftsmen usually begin as copyists or tracers. As they gain additional experience and training and show ability to work without close supervision, they advance to more skilled and responsible drafting jobs.

Administrative positions frequently are filled by men and women who have college degrees in business administration, marketing, accounting, economics, statistics, industrial relations, or other specialized fields. Some companies have advanced training programs in which they give their new employees additional training in their chosen specialties.

Clerks, bookkeepers, and secretaries generally have had commercial courses in high school or business school.

Employment Outlook

Employment in the industry is expected to grow slowly through the 1970's, although production of industrial chemicals is likely to continue to increase rapidly. Most job opportunities will result from the need to replace workers who retire, die, or transfer to other industries. Openings from deaths and retirements alone are expected to average several thousand a year.

Continued emphasis on research and development is expected to stimulate growth in the industrial chemical industry, which has far outstripped most other major industries in the development of new products. Some of these products, such as plastics and synthetics, not only have created new markets but also have competed successfully in markets previously dominated by wood, metals, and natural textiles. Chemical products are expected to continue to make inroads in these markets.

Although industrial chemical production more than doubled between 1960 and 1970, employment increased only 24 percent as a result of the industry's emphasis on technological improvements and the use of automatic processing and control equipment. Increases in output per worker are expected to continue as new plants with the latest equipment are constructed and older plants are modernized.

Some occupational groups in the industry are expected to grow faster than others. The number of professional, technical, and administrative workers is expected to grow more rapidly than the number of plant workers. Emphasis on research and development and greater complexity of products and processes will increase the need for chemists, engineers, technicians, and related personnel.

Because of the increasing use of automatic processing and control equipment, most of the demand for additional plant workers will be for instrument repairmen, pipefitters, electricians, maintenance machinists, and other skilled maintenance workers. Process equipment operators, however, will continue to be the largest occupational group in the industry, although employment of these workers is not expected to increase as much as employment of maintenance workers.

Earnings and Working Conditions

Because a large proportion are skilled, production workers in industrial chemicals have relatively high average earnings. In 1970, production workers in inorganic and organic chemicals averaged $172.58 for a 42.3 hour week or $4.08 an hour; production workers in plastic materials and synthetic rubber, resins, and fibers averaged $151.73 for a 41.8 hour week or $3.63 an hour. In comparison, production workers in manufacturing as a whole averaged $133.73 for a 39.8 hour week or $3.36 an hour.

Entry salaries for inexperienced chemists and chemical engineers in industrial chemicals are among the highest in American industry, according to a 1970 survey conducted by the American Chemical Society. The median starting salary was $810 a month for chemists with a bachelor's degree and $906 a month for chemical engineers. Chemists and chemical engineers with graduate degrees received higher starting salaries.

Paid vacations are universal in this industry and generally are based on length of service. For example, workers in many plants receive 2 weeks of vacation after 1 year of employment, 3 weeks after 5 years, 4 weeks after 10 years and 5 weeks after 20 years.

Most workers are covered by life, sickness, accident, hospitalization, and surgical insurance. Practically all plants have pension plans.

Many employees work in plants that operate around the clock—three shifts a day, 7 days a week. Owing to the widespread industry practice of rotation, processing workers can expect to work the second or third shift at one time or another, usually for extra pay. Very few maintenance workers are employed on shifts. The industry has little seasonal variation and regular workers have year-round jobs.

Except for laborers and material handlers, most industrial chemical jobs require little physical effort. Much of the plant work involves tending, inspecting, repairing, or maintaining machinery and equipment, since most of the processing is controlled automatically or semiautomatically. Some workers are required to climb stairs and ladders to considerable heights. Some jobs are performed out of doors in all kinds of weather.

Workers may be exposed to dust, disagreeable odors, or high temperatures. Chemical companies, however, have reduced these discomforts by installing ventilating or air-conditioning systems. Protective clothing, eye glasses, showers and eye baths near dangerous work stations, and other safety measures have reduced injuries. These devices have helped to make the injury-frequency rate in industrial chemicals less than half that for manufacturing as a whole.

Many production workers in the industrial chemical industry are members of labor unions. The leading unions are the International Chemical Workers Union; Oil, Chemical and Atomic Workers International Union; and International Union of District 50, Allied and Technical Workers of the U.S. and Canada.

Sources of Additional Information

Further information concerning careers in the industry may be obtained from the public relations departments of industrial chemical companies, locals of the unions mentioned above, and from:

American Chemical Society, 1155 16th St. NW., Washington, D.C. 20036.

Manufacturing Chemists' Association, Inc., 1825 Connecticut Ave. NW., Washington, D.C. 20009.

OCCUPATIONS IN THE IRON AND STEEL INDUSTRY

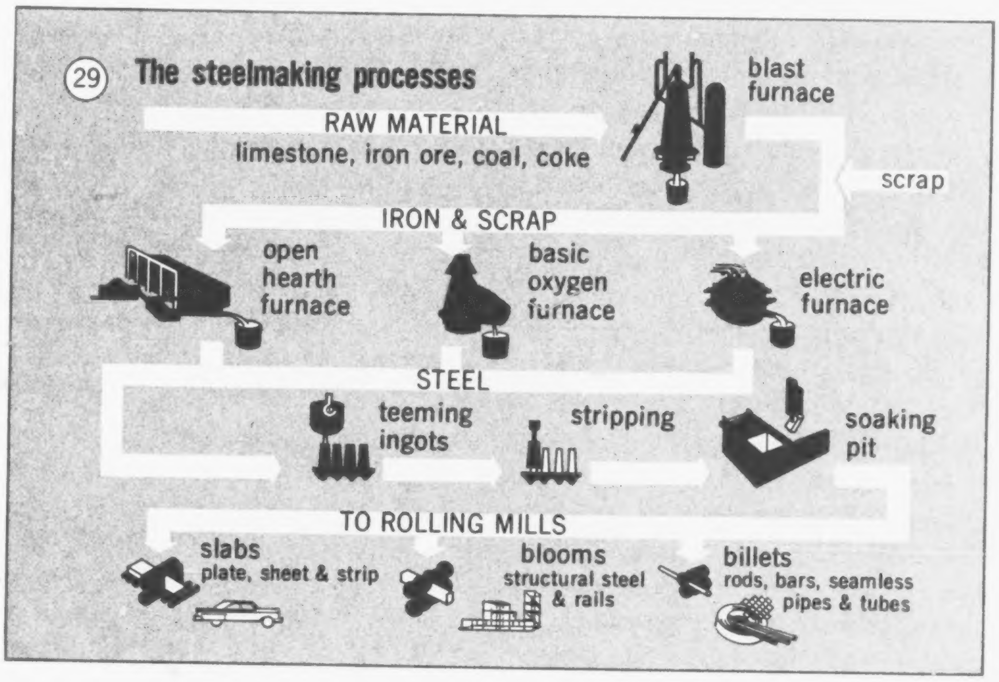
Steel is the backbone of any industrialized economy. There is hardly a product in daily use that has not been made from steel or processed by machinery made of steel. In 1970, United States steelmakers produced approximately 131 million tons of raw steel—about one-fifth of the world's output.

The iron and steel industry is one of the Nation's largest employers. About 629,000 wage and salary workers were on the payrolls of the industry's more than 850 plants in 1970. Employees work in a broad range of jobs requiring a wide variety of skills—from unskilled to technical and professional jobs. Many of these jobs are found only in iron and steelmaking or finishing.

The iron and steel industry, as discussed in this chapter, consists of blast furnaces, steelmaking furnaces, and rolling mills. These include mills engaged in finishing and rolling steel products from purchased sheets, strips, bars and rods, and other materials. The production of iron and steel consists of a closely related series of production processes. First, iron ore is converted to molten iron in blast furnaces. The molten iron is poured into "hot metal cars" and either transported directly to the steelmaking furnace or cast into "pigs" (iron in rough bar form) for use by foundries or by steel mills that do not produce their own iron. (See chart 29 below.) Molten iron or pig iron is then converted into steel in various types of steelmaking furnaces, including basic oxygen, open hearth, and electric furnaces. Molten steel is either poured into ladles and then into ingot molds, or is poured from the ladle directly into continuous casting machines. The ingots are converted into blooms, billets, or slabs on roughing mills, while the steel poured into the casting machine is converted to these semifinished forms, thus bypassing the roughing mill operation. The steel then is rolled into basic products, such as plates, sheets, strips, rods, bars, rails, and structural shapes. Many plants carry the manufacturing processes beyond the primary rolling stage to produce finished products such as pipe, wire, and coated products. (The chapter does not describe the mining or the processing of raw materials used to make steel, or the casting, stamping, forging, machining, or fabrication of steel. These activities are not considered to be in the iron and steel industry, though many domestic steel companies are involved in one or more of these activities. (Employment opportunities in foundry, forging, and machining occupations are discussed elsewhere in the *Handbook*.)

Steel companies differ in the number of operations they perform. Many of them, known as integrated companies, mine and quarry their own coal, ore, and limestone; produce their own coke from coal; reduce ore to pig iron; make steel; and form the steel into products by rolling and other finishing methods. These companies account for the bulk of total steel production and employ most of the industry's workers. Another group of companies makes various types of steel from steel scrap and pig iron purchased from other companies. A third group rolls and finishes purchased raw steel. A fourth type makes only pig iron to be sold to small steel plants and foundries.

Most of the basic products made by steel mills are shipped to the plants of other industries, where they are made into thousands of different products. Some products, however, such as rails, pipe, and nails, are produced in their final form at the mills. The leading steel consuming industries are automobile, construction and building materials, machinery and machine


㉙ The steelmaking processes

tools, containers, and household appliances.

Steel sheets are made into automobile bodies, household appliances, and metal furniture. Steel bars are used to make parts for automobiles and machinery and to reinforce concrete in building and highway construction. Steel plates become parts of ships, bridges, heavy machinery, railroad cars, and storage tanks. Strip steel is used in the manufacture of items such as pots and pans, automobile body parts, razor blades, and toys. Tin coated steel, known as tinplate, is used primarily to make "tin" cans.

Individual plants in this industry typically employ a large number of workers. About 70 percent of all the industry's employees work in plants which have more than 2,500 wage and salary workers. A few plants have more than 20,000 employees. However, many plants employ fewer than 100 workers, particularly those plants which make highly specialized steel products.

Iron and steel producing plants are located mainly in the northern and eastern parts of the United States. Most of the secondary manufacturers who process steel, most of the warehouses that distribute steel sheets and other forms of the metal, and most of the contractors who use I-beams and other construction materials are located in the Northeastern quadrant of the Nation. The heart of U.S. steel manufacturing is a triangular area, about 250 miles on a side, marked off by Johnstown, Pa., Buffalo, N.Y., and Detroit, Mich. Included in this area are major steel producing centers, such as Pittsburgh, Pa., and Cleveland and Youngstown, Ohio. Large plants also are located on the south shore of Lake Michigan near Chicago. The Nation's two largest steel plants, however, are located at Sparrows Point, Md. (near Baltimore), and Gary, Ind. Much of the steelmaking in the South is in the vicinity of Birmingham, Ala., and Houston, Tex. Other steelmaking facilities are located in the Far West at Pueblo, Colo.; Provo, Utah; and Fontana and San Francisco, Calif.

About 7 out of 10 of the industry's workers are employed in five States—Pennsylvania, Ohio, Indiana, Illinois, and New York. Pennsylvania alone accounts for nearly 3 out of 10.

Occupations in the Industry

Workers in the iron and steel industry hold more than 1,000 different types of jobs. Some workers are directly engaged in making iron and steel and converting it into semifinished and finished products. Others maintain the vast amount of machinery and equipment used in the industry, operate cranes and other equipment which move raw materials and steel products about the plants, or perform other kinds of work. In addition, many workers are needed to do clerical, sales, professional, technical, administrative, and supervisory work.

Four-fifths of all employees in the iron and steel industry in 1970 were production and maintenance workers. These workers were directly concerned with the production and finishing of iron and steel, the maintenance of plant equipment, and movement of materials within and among plant departments. The remaining employees were in clerical, sales, professional, technical, administrative, research, managerial, and supervisory occupations.

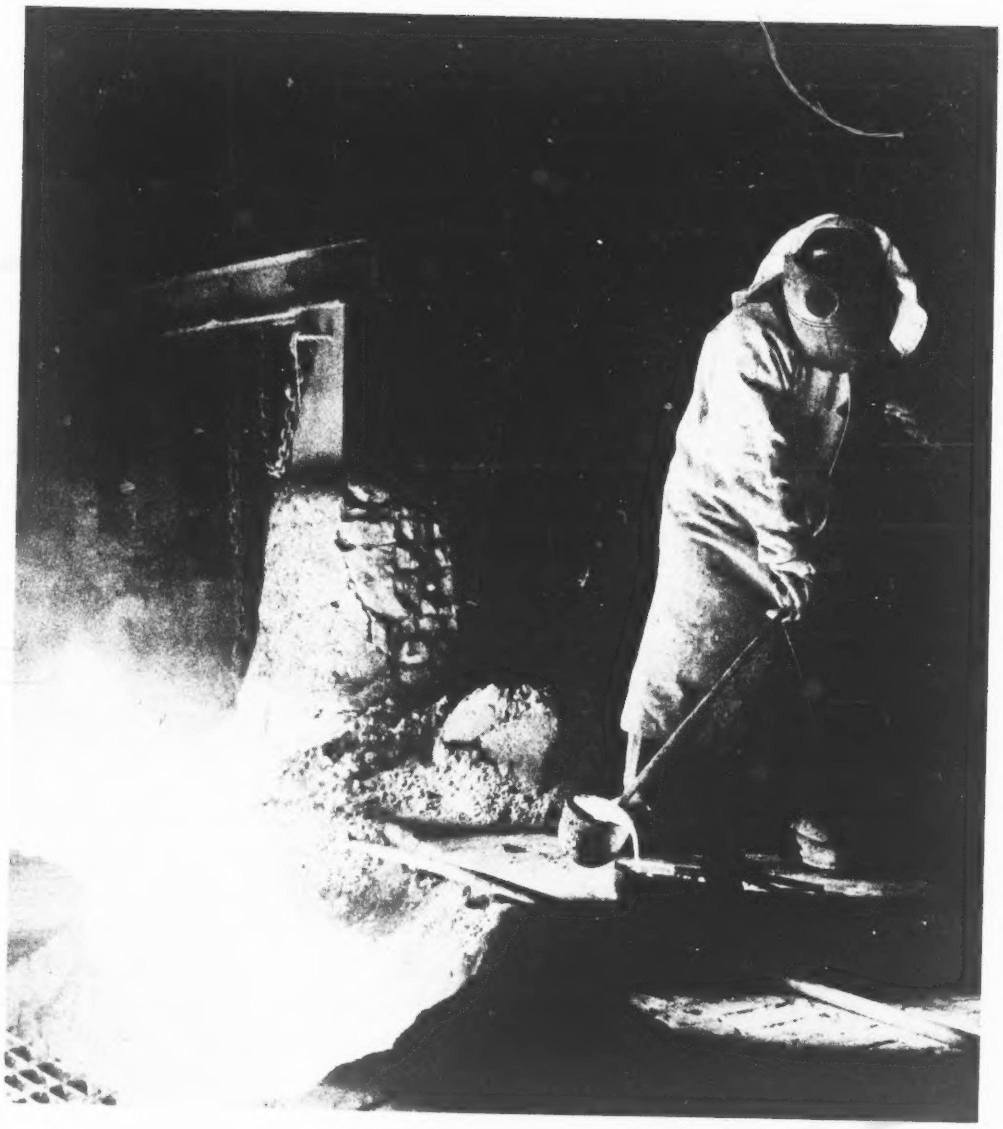
Men constitute 96 percent of all employees in the industry, and an even higher proportion of the production workers. About two-thirds of the women employed in the industry work in supervisory, administrative, technical, research, and clerical jobs. Women in production departments work in jobs such as assorter and inspector.

Processing Occupations. The majority of the workers in the industry are employed in the many processing operations involved in converting iron ore into steel and then into semifinished and finished steel products. To provide a better understanding of the types of jobs, brief descriptions of the major steelmaking and finishing operations and of the more important occupations connected with them are given below.

Blast furnaces. The blast furnace is used to reduce iron ore to molten iron. Iron ore, coke, and limestone are fed into the top of the furnace. Hot air, blown in from the bottom of the furnace, rises through the mass of material and causes combustion. The gases formed by the burning of the coke combine with and remove the oxygen from the ore.

Molten iron trickles down through the charge and collects in a pool at the bottom of the furnace. At the same time, the intense heat causes the limestone to combine with silica and other impurities in the iron ore and coke and to form molten "slag," a useful byproduct. This, too, trickles down through the charge and floats on top of the heavier molten iron. The slag and molten iron ore are separately tapped or "cast" from the blast furnace.

A blast furnace operates continuously, 24 hours a day, 7 days a week, unless it is shut down for repairs or for other reasons. Molten



Molten pig iron is tested for quality.

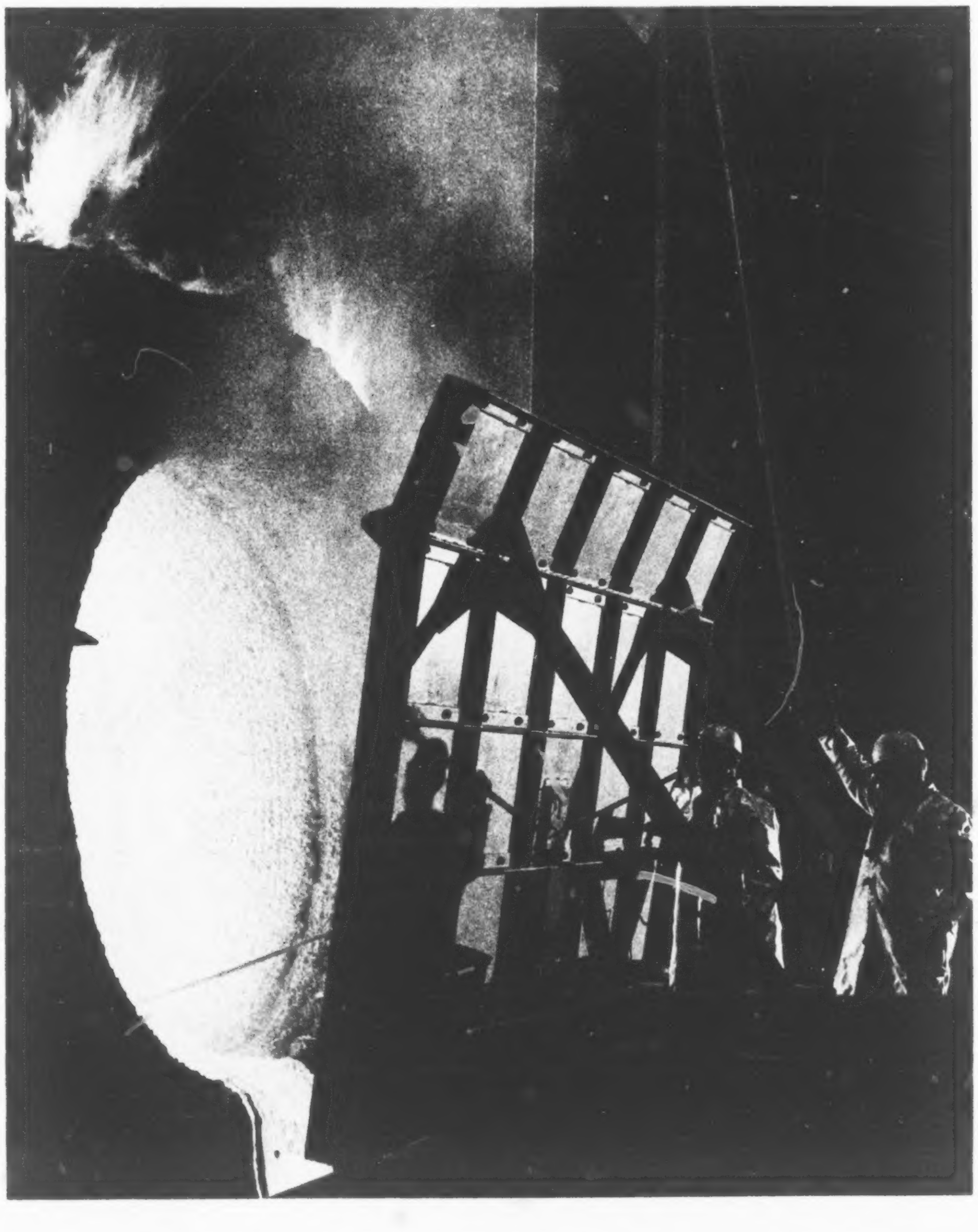
iron may be removed every 3 to 4 hours; slag is removed more frequently. The charging of iron ore, coke, and limestone into the furnace is a continuous operation. A single blast furnace may produce up to 5,000 tons of molten iron in a 24-hour period. Output can be increased to over 7,000 tons per day if pre-reduced iron pellets are used.

The raw materials used in blast furnaces are stored in a stock house below furnace level. Here *stockhouse men or stockhouse larrymen* (D.O.T. 919.883) load traveling stock or larry cars with raw materials from storage bins. They weigh all raw materials according to a prearranged schedule, determined by the kind of hot metal desired. The loaded stock cars are emptied into waiting "skip cars," which carry the materials up tracks to the top of the blast furnace where they are automatically dumped. Other stockhouse men or *skipmen* (D.O.T. 921.883), stationed on the ground below, control the skip cars through electric and pneumatic controls. *Stove tenders* (D.O.T. 512.782) and their assistants operate huge, bricklined stoves which heat air for the blast furnace. They regulate valves to control the heating cycle of the stoves and regulate the flow of heated air to the furnace.

The men responsible for the quantity and quality of iron produced are called *blowers* (D.O.T. 519.132). They direct the operation of one or more blast furnaces, including loading and tapping the furnace, and regulating the air blast and furnace heat. Blowers carefully check the metal produced, periodically sending samples of the molten iron and slag to the laboratory where quality tests are made and the results reported to the blower. *Keepers* (D.O.T. 502.884), under the direction of the blower, are responsible for tapping the furnace. They direct their helpers and *cindermen* or *slaggers* (D.O.T. 519.887) in lining (with special refractory sand) the troughs and runners through which the molten iron and slag are run off into waiting cars.

Steel furnaces. The second major step in steelmaking is to convert the iron into steel. This is done in several types of furnaces: basic oxygen, open hearth, and electric.

About half of all domestic steel is made in basic oxygen furnaces (BOF), and this proportion is expected to increase. Basic oxygen furnaces can make steel faster than any other type of furnace currently in use, and continual displacement of the open-hearth steelmaking process by the basic oxygen method is expected. Many basic oxygen furnaces can produce more than 6,000 tons of steel in a 24-hour period. In this steelmaking process, oxygen is "blown" into the furnace through vertical pipes, or "lances," after it has been loaded with steel scrap and molten pig iron. Limestone and other slag forming materials are



Melter helpers take temperature of steel in basic oxygen furnace.

added to remove impurities from the steel. The use of oxygen speeds the steelmaking process because it is blown directly onto the molten metal forcing a faster chemical reaction and a higher bath temperature. BOF's are often computer controlled to improve the quality of the steel produced and to speed up the steelmaking process.

A *melter* (D.O.T. 512.132) is in charge of one or more furnaces and is responsible for the quality and quantity of the steel produced. The melter makes the steel to the desired specifications by varying the proportions of limestone, iron ore, scrap steel, and molten pig iron in the furnace, and by adding small amounts of other materials such as manganese, silicon, copper or other alloy additives. He supervises three grades of helpers—*first* (D.O.T. 512.782), *second* (D.O.T. 502.-884), and *third* (D.O.T. 519.887). These helpers prepare the furnaces for the heat, regulate furnace temperatures, take samples of molten steel for laboratory tests, direct the adding of various alloying materials, and tap the molten steel from the furnace into a ladle. One first helper is responsible for each furnace.

When the heat of steel is ready to be tapped, the furnace crew knocks out a plug in the furnace with a "jet tapper" (small explosive charge which is fired into the plug) which allows the molten metal to flow into a ladle. The slag, which floats to the top of the ladle, overflows into a smaller ladle called a slag pot.

The molten steel then is poured or "teemed" from the ladle into ingot molds (hollow cast iron forms). A *ladle craneman* (D.O.T. 921.883) operates an overhead crane which picks up the ladle and moves it over a long row of ingot molds resting on flat-bottom cars. The *steel pourer* (D.O.T. 514.884) operates a stopper on the bottom of the ladle to let the steel flow into the molds.

As soon as the steel in the molds has solidified sufficiently, an *ingot stripper* (D.O.T. 921.883) operates an overhead crane, which removes the molds from the ingots. The still-hot steel ingots are placed on "ingot buggies" (four-wheel carts running on rails) for movement to the soaking pits or storage areas.

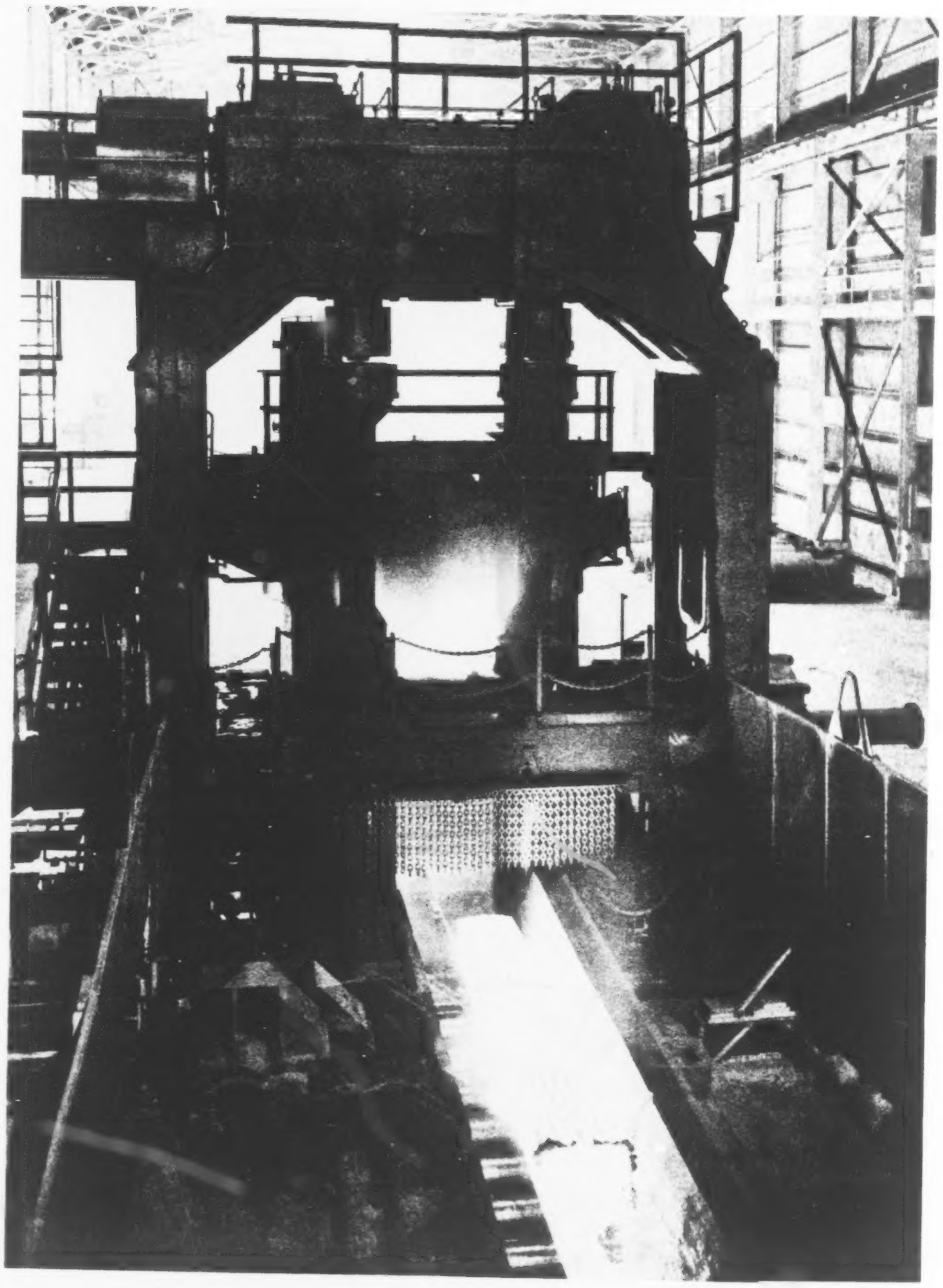
Open-hearth steel, which accounts for slightly more than one-third of all steel manufactured in the United States, is produced by adding molten pig iron to previously charged and heated steel scrap and limestone and melting the mixture in furnaces. It is possible to make from about 125 to more than 600 tons of steel per load or "heat", depending upon the size of the furnace. Most of the open-hearth steelmaking facilities now use oxygen in the refining operation to speed up the process.

Electric furnaces account for the

remainder—about 15 percent—of domestic steel production. In electric furnaces, steelmaking can be controlled very closely. Consequently, such furnaces are used to produce high quality and high alloy specialty steels, such as tool and stainless, as well as the more common steels.

Rolling and finishing. The three principal methods of shaping metal in steel plants are rolling, casting, and forging. About three-fourths of all steel products are shaped by the rolling process. In this method, heated steel ingots are squeezed longer and flatter between two cylinders or "rolls." Before ingots of steel are rolled, they are heated to the temperature specified by the plant's metallurgist. The heating is done in large furnaces called "soaking pits," located in the plant floor. A *heater* (D.O.T. 613.782) controls the soaking pit operation. He directs helpers in heating the ingots to the specified temperature and, with the help of control equipment, determines when they are ready for rolling. A *soaking pit craneman* (D.O.T. 921.883) operates an overhead crane, by means of electrical controls, to lift the stripped ingots from an ingot car and place them into the soaking pit. When the ingots are sufficiently "soaked" with heat, the heater opens the furnace covers and the craneman removes the ingots and places them on an ingot buggy, which carries them to the first rolling mill, sometimes called a "break down" mill. Here, the ingots are rolled into semifinished shapes—blooms, slabs, or billets. Blooms are generally more than 6 inches wide and 6 inches thick. Slabs are much wider than blooms. Billets are the smallest of these three shapes.

The rolling of blooms illustrates the semifinishing process. In the blooming mill, as in other rolling mills, the ingot moves along on a roller conveyor to a machine which resembles a giant clothes wringer. A "two-high" blooming mill has two heavy grooved rolls which revolve in opposite directions. The rolls grip the approaching ingot and pull it between them, squeezing it thinner and longer. When the ingot has made one pass through the rolls, the rolls are reversed, and the ingot is fed back through them. Throughout the rolling operation, the ingot is periodically turned 90 degrees by mechanical devices called "manipulators," and passed between the rolls again so that all sides are rolled. Guides, located on each side of the roll table, properly position



Hot steel ingots are reduced to slabs and blooms.

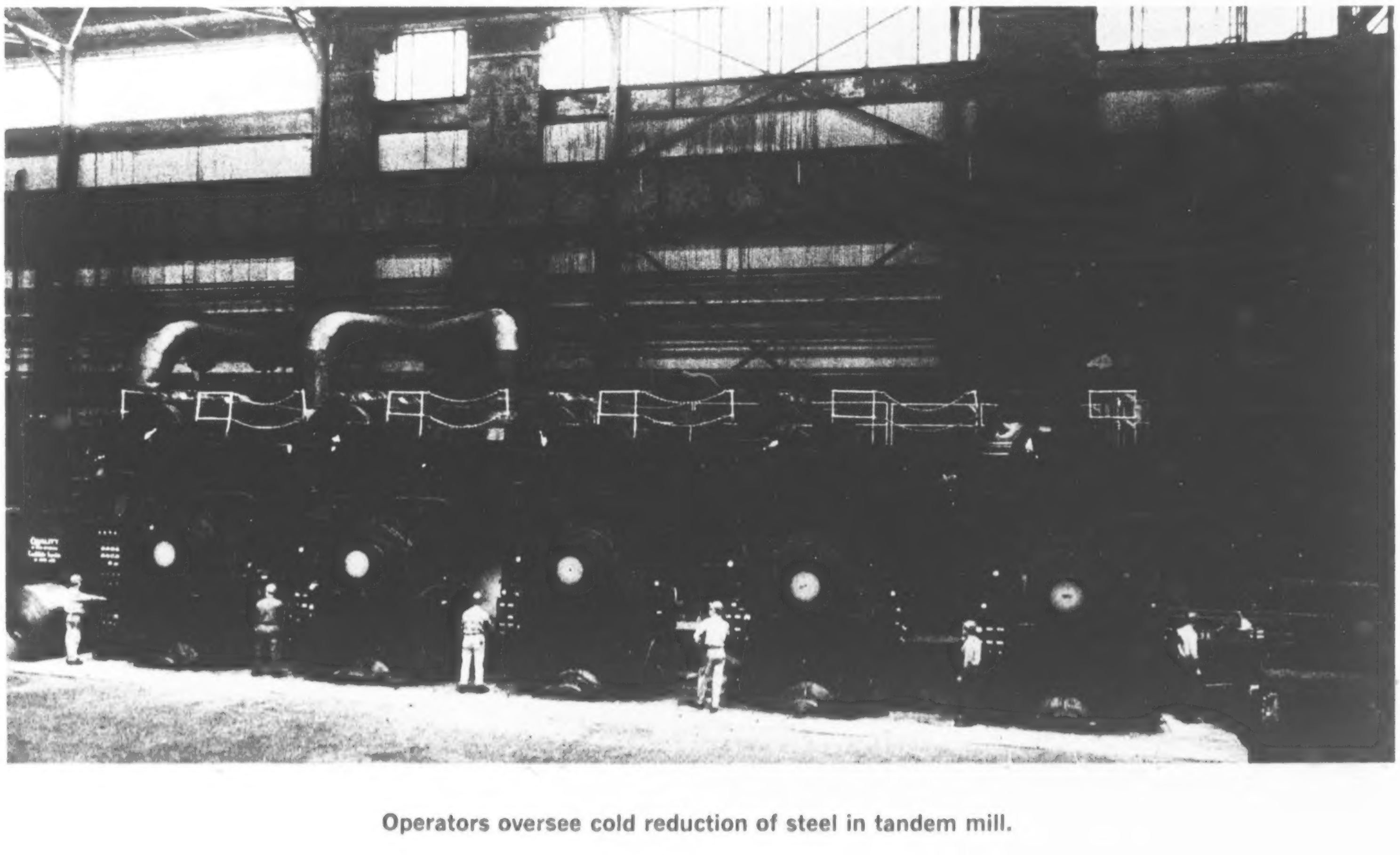
the ingot for entry into the rolls. This operation is repeated until the ingot is reduced to a bloom of the desired size. The bloom then is ready to be cut to specified lengths.

A blooming mill *roller* (D.O.T. 613.782), the man in charge of the mill, works in a glass-enclosed control booth, or "pulpit," located above or beside the roller line. His duties, which appear to consist principally of moving levers and pushing buttons, look relatively simple. However, the quality of the product and the speed with which the ingot is rolled depends upon his skill. The roller regulates the opening between the rolls after each pass. Long experience and a knowledge of steel characteristics are required for a worker to become a roller. A *manipulator operator* (D.O.T. 613.-782) sits in the pulpit beside the roller and coordinates his controls over the ingot's position with those of the roller.

Upon leaving the rolling mill, the red-hot bloom moves along a roller conveyor to a place where a *shearman* (D.O.T. 615.782) controls a heavy hydraulically operated shear which cuts the steel into desired lengths.

In a blooming mill with automatic (electronic) process controls, a rolling mill attendant is given a card which has been punched with a series of holes. The holes represent coded information and directions as to how the ingot is to be rolled. The attendant inserts the card into a card "reader," then presses a button that starts the rolling sequence. The information in punched-card form governs the setting of the roll opening, the speed of the rolls, the number of passes to be made, and the number of times the ingot must be turned. When the automatic process is used, the roller's function is shifted from operating the rolling controls to directing and coordinating the entire rolling process. This consists of heating, rolling, and shearing.

Of increasing use in steel shaping is the continuous casting process. In this process, which eliminates the necessity of conventional pouring pits to produce large ingots that in turn must be put through huge blooming and slabbing mills, molten steel is poured into a water-cooled mold of the desired product shape located at the top of a tower. As the mold is filled, the steel solidifies along the bottom and lower sides. The mold bottom is then withdrawn and the slab or billet starts its descent through the tower. As the ribbon emerges from the mold, additional molten steel is continuously



Operators oversee cold reduction of steel in tandem mill.

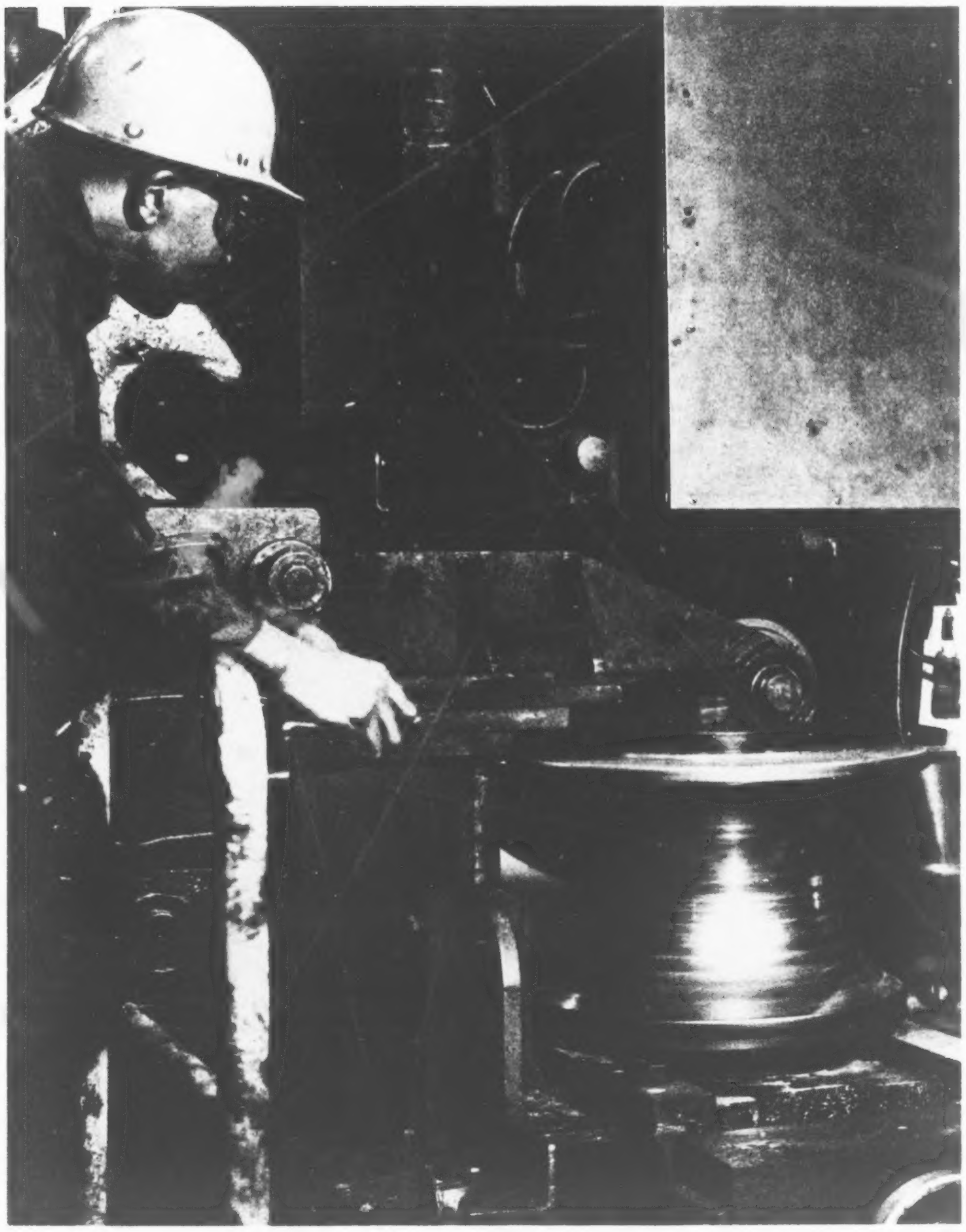
added at the top. Continuing downward, it passes through a spray chamber where it is further cooled by a water spray to solidify the still liquid core. Pinch rolls control its descent and support its weight. Finally, the slab or billet is cut into lengths as it emerges from the rolls. In some continuous casting installations, a curved mold is used so that the product comes out horizontally rather than vertically.

After the steel is rolled into semifinished shape—blooms, slabs, or billets—most of it is put through finishing operations. For example, steel slabs may be reduced and shaped into plates and sheets. Even after additional rolling, some steels must be worked further. Some rods, for instance, are reduced to wire by drawing. Wire can be further processed into wire rope, nails, fencing, or other end products. Much sheet steel is reduced further by cold-rolling, and then it may be run through galvanizing or tinplating lines.

Equipment operator, inspector, and *assorter* are among the major occupations in finishing operations; women frequently are employed in these jobs.

An important occupation in wire making is the *wire drawer* (D.O.T. 614.782). This worker pulls the pointed end of a steel rod through a die (a block of hard steel or sintered carbide with a tapered hole in it). The rod end then is attached to a reel which, while revolving, pulls the rest of the rod through the die. As the rod passes through the die, it is made thinner and longer and becomes wire, which is coiled automatically around the revolving reel. If extensive reduction of the rod is required, it is passed through a series of dies, each die reducing the diameter of the wire slightly.

Pipe, both welded and seamless, is also an important steel mill product. In making welded pipe, the flat steel is fed into a machine which through a series of forming rolls converts it into tube shape; then the edges of the pipe are fused by continuous welding.



Worker checks production of pipe in electric-resistance weld mill.

Seamless pipe and tubing are formed from a solid billet of steel, called a tube round. In the seamless operation, the *piercer-machine operator* (D.O.T. 613.885) passes a preheated "tube round" between two barrel-shaped rolls. The revolving rolls spin the "tube round" and force one end against a piercing plug or "mandrel." The combined rolling action and the pressure of the rolls tend to make the steel draw apart providing space for the mandrel to enter. The mandrel smooths the inside walls and makes the diameter of the hole uniform.

Tinplate is another important steel product. To make tinplate, thin gauge steel in coil form is fed continuously through an electrolytic bath where a coat of tin is deposited on the steel.

Maintenance, Transportation, and Plant Service Occupations. Large numbers of workers are required in steel plants to support processing activities. Some maintain and repair machinery and equipment, and others operate the equipment which provides power, steam, and water. Other groups of workers move material and supplies and perform a variety of service operations.

In the machine shops, machinists and machine tool operators make and repair metal parts for machinery or equipment. Diemakers use machine tools to form dies, such as those used in wire drawing units. *Roll turners* (D.O.T. 613.780) use lathes, grinders, and other machine tools to finish steel rolls to desired shapes and sizes for use in the rolling mills.

Millwrights in this industry maintain mechanical equipment. They overhaul machinery and repair and replace defective parts. Electricians install electric wiring and fixtures and hook up electrically operated equipment. Electrical repairmen (motor inspectors) keep wiring, motors, switches, and electrical equipment in good operating condition and make repairs when electrical equipment breaks down.

Electronic repairmen install, repair, and adjust the increasing number of electronic devices and systems used in steel manufacturing plants. Typically, this equipment includes communication systems such as public address systems; closed-circuit television installations; electronic computing and data recording systems; and measuring, processing, and control devices such as X-ray measuring or inspection equipment.

Bricklayers repair and rebuild the brickwork in furnaces, soaking pits, ladles, and coke ovens, as well as mill buildings and offices. Pipefitters lay out, install, and repair piping that is used to carry the large amount of water, gas, steam, oil, air, oxygen, and acetylene used in the steelmaking process. Boilermakers test, repair, and rebuild heating units, storage tanks, stationary boilers, and condensers. Locomotive engineers and other train crew members operate diesel or electric trains used to transport materials and products in the vast yards of iron and steel plants. Welders use welding equipment to join metal parts in repairing and rebuilding plant machinery and in fabricating steel products. Skilled workers operate the various boilers, turbines, and switchboards in the powerplants which provide the large amounts of electric power needed in steelmaking.

Other types of maintenance and service workers found in steel plants include carpenters, oilers, painters, instrument repairmen, scale mechanics, loaders, riggers, greasers, janitors, and guards. Many laborers are employed to load and unload materials and do a variety of cleanup operations.

Administrative, Clerical, and Technical Occupations. Professional, technical, administrative, clerical, and sales workers account for about one-fifth of the industry's total employment. Of these, the majority are clerical workers, such as secretaries, stenographers, typists, accounting clerks, and general office clerks.

Engineers, scientists, and technicians make up a substantial proportion of the industry's white-collar employment. Several thousand of these workers perform research and development work to improve existing iron and steel products and processes, and to develop new products and processes.

The technical specialists in iron and steel plants also include mechanical engineers, whose principal work is the design, construction, and operation of mill machinery and material handling equipment. Many mechanical engineers work in operating units where their jobs include, for example, determination of roll size and contour, rolling pressures, and operating speeds. Others are responsible for plant and equipment maintenance. Metallurgists and metallurgical engineers work in laboratories and production departments where they have the important task of specifying, controlling, and testing the quality of the steel during its manufacture. They also develop and improve the industry's products and processes through research. Civil engineers are engaged in the layout, construction, and maintenance of steel plants, and the equipment used for heat, light, and transportation. Electrical engineers design, lay out, and supervise the operation of electrical generating distribution facilities that provide the power essential in modern steel mill operation. These engineers also are concerned with the operation of electrical machinery and electrical and electronic control equipment.

Chemists work in the laboratories, making chemical analyses of steel and raw materials used in steel manufacture. Laboratory technicians do routine testing and assist chemists and engineers. Draftsmen prepare working plans and detailed drawings required in plant construction and maintenance.

Among the employees in administrative, managerial, and supervisory occupations are office managers, labor relations and personnel managers, purchasing agents, plant managers, and industrial engineers. Working with these personnel are several thousand professional workers other than scientists and engineers. By far, the largest group of these professional employees are accountants, but there are also many nurses, lawyers, economists, statisticians, and mathematicians. In addition, the industry employs several thousand professional workers in sales positions.

(Detailed discussions of professional, technical, mechanical, and other occupations found in the iron and steel industry, as well as in many other industries, are given elsewhere in the *Handbook*.)

Training, Other Qualifications, and Advancement

New workers in processing operations usually are hired at the unskilled level as laborers. Openings in higher rated jobs usually are filled by promoting workers from lower grade jobs. Factors considered when selecting workers for promotion are ability to do the job, physical fitness, and length of service with the company.

Training for processing occupations is done almost entirely on the job. Workers move to operations requiring progressively greater skill as they acquire experience. A craneman, for example, first is taught how to operate relatively simple cranes, and then he advances through several steps to cranes much more difficult to run, such as the hot-metal crane.

To help them advance in their work, many employees take part-time courses in subjects such as chemistry, physics, and metallurgy. In some cases, this training is provided by the steel companies and may be given within the plant. Other workers take evening courses in high schools, trade schools, or universities in their communities or enroll in correspondence courses.

Workers in the various operating units usually advance along fairly well-defined lines of promotion within their department. Examples of possible lines of advancement in the various operating units are described in the next paragraph.

To become a blast furnace blower, a worker generally starts as a laborer, advancing to cinderman or slagger, keeper's helper, keeper, blower's helper, and finally to blower. In the open-hearth department, a man may begin by doing general cleanup work around the furnace and then advance to third helper, second helper, first helper, and eventually to melter. A possible line of job advancement for a roller in a finishing mill might be pitman, roll hand, manipulator, rougher, and finish roller. Workers may be trained for skilled jobs, such as blower, melter, and roller, which are among the highest rated steelmaking jobs, in a minimum of 4 or 5 years, but usually they have to wait a much longer time before openings occur.

Most companies conduct some type of apprenticeship program to meet the needs of their maintenance shops. There are apprentice training programs for more than 20 different crafts in the steel industry. The apprenticeship programs for maintenance workers usually are of 3 or 4 years' duration and consist mainly of shop training in various aspects of the particular jobs. In addition, classroom instruction in related technical subjects usually is given, either in the plant or in local vocational schools.

Steelmaking companies have different qualifications for apprentice applicants. Generally, employers require applicants to have the equivalent of a high school or vocational school education. In most cases, the minimum age for applicants is 18 years. Some companies give aptitude and other types of tests to applicants to determine their suitability for the trades. Apprentices generally are chosen from among qualified young workers already employed in the plant. The following occupations are among those most often included in apprentice training programs in iron and steel plants: blacksmith, boilermaker, bricklayer, carpenter, coremaker, electrician, instrument repairman, lead burner, machinist, millwright, molder, patternmaker, pipefitter, rigger, roll turner, sheet-metal worker, tool and die maker, and welder.

Applicants for jobs as maintenance workers' helpers usually are given aptitude tests. Helpers receive on-the-job training and may be promoted to jobs requiring greater skill as openings occur. However, vacancies in these higher grades may not occur for several years, depending on the rate of turnover.

The minimum requirement for engineering and scientific jobs is usually a bachelor's degree with an appropriate major. Practically all the larger companies have formal training programs for college-trained technical workers. In these programs, the trainees work for brief periods in various operating and maintenance divisions to get a broad picture of steelmaking operations before they are assigned to a particular department. In other companies, the newly hired scientist or engineer is assigned directly to a specific research, operating, maintenance, administrative, or sales unit. Engineering graduates frequently are hired for sales work and many of the executives in the industry have engineering backgrounds. Engineering graduates, as well as graduates of business administration and liberal arts colleges, are employed in jobs in sales, accounting, and labor-management relations, as well as in managerial positions.

Completion of a business course in high school, junior college, or business school usually is preferred for entry into most of the office occupations. Office jobs requiring special knowledge of the steel industry generally are filled by promoting personnel already employed in the industry.

Employment Outlook

Employment in the iron and steel industry is expected to decline slowly through the 1970's, principally because of increased output per worker resulting from continued mechanization. Nevertheless, many thousands of new workers will be needed annually to replace those who retire, die, or leave the industry for other reasons.

Demand for iron and steel is expected to increase moderately during the 1970's. Rising population and income levels will result in a greater need for products that require large amounts of steel—for example, automobiles and household appliances, industrial plants and machinery, and residential and commercial buildings. Domestic production, however, probably will not increase as fast as demand because imported steel has absorbed some of the market growth in recent years and this trend may continue.

Despite the expected decline in overall employment, employment in some occupations or occupational groups still is expected to rise. Among white-collar workers, for example, employment of engineers, metallurgists, laboratory technicians, and other technical personnel will increase because of the industry's expanding research and development programs. Job opportunities for accountants, statisticians, electronics technicians, computer programers, and other personnel trained in the preparation of data for use in these machines also are expected to increase. Among skilled plant personnel, maintenance workers (particularly instrument and electronics repairmen) are expected to be needed in greater numbers because of the increasingly complex machinery, instruments, and other equipment used. In contrast, the number of unskilled laborers is expected to decline.

Earnings and Working Conditions

Earnings of production workers in iron and steelmaking establishments are among the highest in manufacturing. In 1970, their earnings averaged $166.40 a week or $4.16 an hour. This compares with average earnings of $133.73 weekly, or $3.36 an hour, for all production workers in manufacturing establishments.

Agreements between most steel companies and the United Steelworkers of America include some of the most liberal benefits in industry. Most workers receive vacation pay ranging from 1 to 4 weeks, depending on length of service. A worker in the top 50 percent of a seniority list receives an additional 13-week vacation every 5 years; the remaining workers receive 3 extra weeks vacation once in a 5-year period. Professional and executive personnel in a few companies receive similar benefits.

Workers may retire on full pension after 30 years of service, regardless of age. Retiring workers are eligible for a company-paid pension, in addition to social security benefits for which they may be eligible. Employees having 2 years or more of service are eligible to receive supplemental unemployment benefits for up to 52 weeks. Other important provisions include accident and sickness, hospitalization, surgical, and life insurance benefits,

Basic Straight-time Hourly Earnings[1] of Workers In Selected Occupations in Basic Iron and Steel Establishments. Early 1971

	Hourly earnings
Blast furnaces:	
Larrymen	$3.565
Stock unloaders	3.055
Basic oxygen furnaces:	
Steel pourers	4.075
Furnace operators	4.500–4.755[2]
Open hearth furnaces:	
Charging machine operators	4.075
First helpers	4.755
Bloom, slab, and billet mills:	
Soaking pit cranemen	3.990
Manipulators	3.820
Continuous hot-strip mills:	
Assorters	3.480
Coilers	3.650
Maintenance:	
Bricklayers	4.160
Millwrights	4.075

[1] Excludes premium pay for overtime and for work on weekends, holidays, and late shifts. Incentive payments, such as those resulting from piecework or production bonus systems and cost-of-living allowances, are included.

[2] Depending on size of furnace.

and education and scholarship assistance.

Working conditions vary by department. Maintenance shops generally are clean and cool. Rolling mills, however, generally are hot and noisy. Some plants are developing methods to reduce job discomfort. For example, the use of remote control enables employees to work outside the immediate vicinity of processing operations. In other instances, the cabs in which the men work while operating mechanical equipment, such as those on cranes, are air-conditioned. Some of the workers near blast and steel furnaces are exposed to considerable dirt, noise, and heat. Because certain processes are operated continuously, many workers are on night shifts or work on weekends.

The iron and steel industry is a leader in the development of safety programs for workers, emphasizing the use of protective clothing and devices on machines to prevent accidents. In recent years, steel plants had an average injury frequency rate (injuries per million hours of work) that was less than half the rate of all manufacturing.

Most plant workers in the iron and steel industry are members of the United Steelworkers of America.

Sources of Additional Information

American Iron and Steel Institute,
150 East 42nd St., New York,
N.Y. 10017.

United Steelworkers of America,
1500 Commonwealth Building,
Pittsburgh, Pa. 15222.

MOTOR VEHICLE AND EQUIPMENT MANUFACTURING OCCUPATIONS

Few products have as great an impact on everyday life as the automobiles, trucks, buses, and other vehicles manufactured by the motor vehicle and equipment industry (automobile industry). In 1970, 4 out of 5 families owned at least one automobile, and 1 family out of 4 owned two or more. Altogether, about 105 million passenger cars, trucks, and buses traveled the Nation's streets and highways.

The widespread use of motor vehicles has contributed significantly to the Nation's economy by creating new industries including automotive repair shops, gasoline service stations, and truck and bus transportation facilities. Moreover, the automobile industry is a major consumer of many basic commodities such as steel, rubber, and plate glass.

To manufacture the nearly 8.3 million motor vehicles (mainly automobiles) produced in 1970, the motor vehicle industry (SIC 371) employed approximately 810,000 workers. In addition to workers discussed in this chapter, thousands of people are employed in other industries which produce automotive stampings, automobile glass, lighting systems, storage batteries, tires, and many other components.

Stylists discuss fabric design for automobile interior.

The automobile industry employs men and women having widely different education and training. Job requirements vary from a college degree for engineers and other professional and technical personnel, to a few hours of on-the-job training for assemblers, materials handlers, and custodial employees. The largest number of employees work in factory (plant) occupations. Plant occupations range from the skilled tool and die maker, millwright, and electrician, to those requiring little skill such as machine tender, assembler, materials handler, and custodial worker. A great number of employees also work as clerks, business machine operators, stenographers, purchasing agents, and personnel assistants.

Nature and Location of the Industry

This industry's ability to produce millions of complex motor vehicles is due mainly to mass production of standardized parts and assembly line manufacturing methods. These mass-produced parts are put together to form the completed vehicle. As a result, new cars can be driven off assembly lines at the rate of more than one a minute.

The motor vehicle industry in 1970 consisted of about 2,700 establishments ranging in size from huge assembly plants employing several thousand workers, to small parts plants having only a few workers. About 85 percent of the industry's employees, however, worked in plants having 500 or more employees.

About 43 percent of the industry's employees worked in plants that produced complete vehicles. Another 43 percent worked in plants that produced parts and accessories such as brakes and transmissions. The remainder worked in plants that produced automobile bodies, truck and bus bodies, and truck trailers.

Eighty-six percent of the workers in the industry are employed in 10 States. Michigan alone accounts for 40 percent of the total; Ohio, Indiana, and New York account for another 27 percent. The six other leading States are Missouri, California, Wisconsin, Illinois, Pennsylvania, and New Jersey.

The center of the industry is the Detroit metropolitan area where 1 out of 4 motor vehicle workers is employed. Other important areas in the Great Lakes region include Flint, Lansing, and Saginaw, Michigan; Cleveland, Lorain, Toledo, and Cincinnati, Ohio; Indianapolis and Fort Wayne, Ind.; Chicago, Ill.; Buffalo, N.Y.; and Milwaukee and Kenosha, Wis.

Much of the motor vehicle manufacturing on the East Coast is centered in the New York–New Jersey-Philadelphia industrial area in localities such as Newark, Paterson, Linden, and New Brunswick, N.J.; and New York, N.Y.

Leading automobile manufacturing centers in the Pacific Coast region are Los Angeles and San Francisco, California.

How Motor Vehicles Are Made

Automobiles and other motor vehicles are produced in three stages: preliminary designing and engineering, production of motor vehicle parts and subassemblies, and final assembly of parts into complete vehicles.

Preliminary Designing and Engineering. Approximately 2 to 3 years of designing, planning, and testing often precede the actual production of each year's model. Stylists develop the original design which determines the overall appearance of the automobile. They work closely with engineers and other technical personnel to improve mechanical operation, design, and safety. From blueprints, drawings, and sketches of stylists and engineers, skilled modelmakers make scale and full size clay models of the automobile interior and exterior, which are used to develop refinements in styling and design. To mass-produce the automobile, master dies based on the final model are made.

In recent years, computers and numerically controlled drafting machines have played an increasingly important role in engineering. These drafting machines automatically produce engineering drawings from a tape containing instructions prepared on a computer. Another technique is the use of photographic equipment to record points on a clay model, which the computer then converts into full scale drawings. Computerized data also are fed into numerically controlled die making machines which produce

Woodworker builds skeleton for full-size model of car interior.

master dies. These methods have enabled manufacturers to shorten the lead time required to prepare new models for production.

Production of Motor Vehicle Parts. After the design and engineering phases have been completed, thousands of parts that will later be assembled into a complete vehicle must be produced. A large variety of materials are used, including steel, aluminum, copper, zinc, nickel, plastic, rubber, fabric, glass, iron, and lead.

Metal parts are shaped by several different methods, depending on the purpose and size of the part and the metal being used. The casting process is used to produce bulky parts such as engine blocks. Parts which must withstand great stress, such as axles, are forged. Huge presses form the sheet metal and aluminum that compose the exterior body. Metal parts requiring precise dimensions, such as pistons and engine blocks, undergo further machine processing. These various processes are explained more fully under plant occupations.

The production of parts does not consist entirely of metalworking operations. For example, many parts are painted, seat cushions are prepared, and engines are test run. Throughout production numerous inspections are made to insure that assembled vehicles will meet quality and safety standards.

Assembling the Final Product. Banks of parts and subassemblies located in storage areas along the assembly line are continually fed to assemblers according to a carefully scheduled system. As the conveyor carries the chassis along the line, assemblers attach the parts and subassemblies in proper sequence. Near the end of the line, accessories such as hubcaps and floor mats are added; gasoline is pumped into the fuel tank, and the new vehicle is driven off the line. Finally, the headlights and wheels are aligned and the finished vehicle is inspected.

The sequence of models to be built may be transmitted to the various stations along the line by teletype or telautograph. Information on color and special equipment for each car is obtained from orders placed by automobile dealers. By this scheduling program, cars of different colors and types follow each other on the assembly line—for example, a blue sedan may follow a beige station wagon.

Occupations in the Industry

The motor vehicle industry employs workers in hundreds of occupations. Semiskilled plant workers, such as assemblers, inspectors, and materials handlers, made up about one-half of all employees. An additional one-quarter were employed as foremen, mechanics and repairmen, machinists, tool and die makers, and in other skilled occupations. Clerical employees made up about one-tenth of the total. The remaining workers were employed in professional, technical, sales, and managerial occupations, and as unskilled workers and guards. More than nine-tenths of the industry's employees are men. Of the women employed, about half are in production jobs such as assembling and inspecting. The rest are in clerical and other office jobs, including research and technical work.

The duties and training requirements of some of the important occupations are described briefly below. (Detailed discussions of professional, technical, mechanical, and other occupations found in the automobile industry, as well as in many other industries, are given in the sections of the *Handbook* covering individual occupations.)

Professional and Technical Occupations. The modern automobile is a product of the research, design, and development work of thousands of engineers, chemists, metallurgists, mathematicians, draftsmen, and other professional, scientific, and technical personnel. About 30,000 scientists and engineers were employed in the industry in 1970. Engineers make up the largest group of professional and technical workers in the industry. Motor vehicle companies hire engineers specializing in mechanical, electrical, industrial, and other fields. The mechanical engineer seeks ways of improving the engine, transmission, or other parts of the automobile through research and development. The electrical engineer designs electrical parts, such as ignition systems and voltage regulators. The industrial engineer concentrates on the layout of plant equipment, establishing work standards, and improving production processes and scheduling. The industry also employs metallurgists, and civil, chemical, and ceramic engineers.

About two-fifths of the scientists and engineers are engaged principally in research and development. Others may supervise technical production workers. For example, metallurgists may supervise the melting operations in the precision casting and forging departments, and chemists may head the testing and analytical laboratory.

Draftsmen, the largest group of technical employees, work closely with engineers to design and develop components. The industry also employs thousands of other technicians, such as engineering aids

Draftsman checks automobile design drawings prepared by numerically controlled drafting machine.

and laboratory assistants, to assist engineers and scientists.

Administrative, Clerical, and Related Occupations. Executives determine the number and styles of vehicles to produce, what prices to charge, which parts to buy, and plant locations. Other administrative personnel such as purchasing agents and personnel managers direct individual departments or special phases of operations. Assisting administrators are accountants, lawyers, market analysts, economists, statisticians, and industrial relations experts. Many supervise specific groups of office or plant employees.

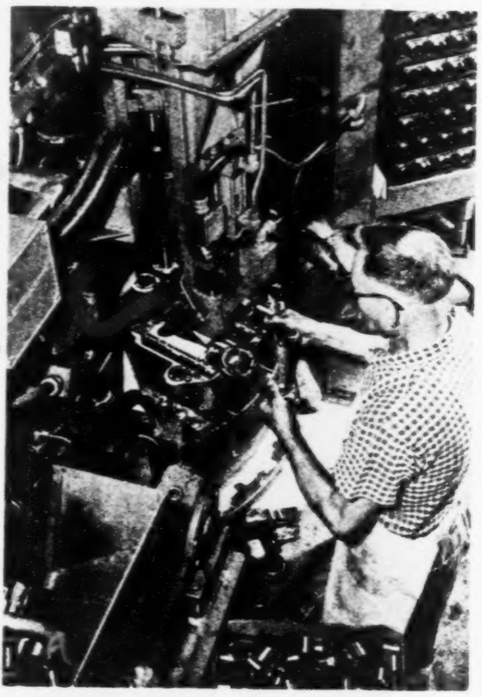
The large staff of clerical workers, many of whom are women, includes secretaries, stenographers, bookkeepers, clerk-typists, key punch operators, and business machine operators.

Plant Occupations. About three-fourths of the employees in the motor vehicle industry work in production operations. Most plant employees make and assemble parts into complete vehicles. Others service and maintain machinery and equipment.

Machining Occupations. Machining is the method generally used to shape parts to precise dimensions. Lathes, drill presses, boring, grinding, and milling machines, and other machine tools cut or chip away excess metal.

One of the largest metalworking occupations in the industry is the machine tool operator who runs machines which cut, shape, drill, or grind metal. The job title, such as engine lathe operator or drill press operator, depends on the type of machine tool operated.

Among the most highly skilled machining workers are tool and die makers. Toolmakers build and repair tools and the jigs, fixtures, and other accessories that hold the metal being machined. Diemakers construct the dies used in stamping, pressing, forging, and other metal-forming operations. Tool and die makers read blueprints, set up and operate machine tools, use precision measuring instruments, and make shop computations.



Press operator runs automatic index machine to form automobile parts.

As a step in the automation of machining processes, manufacturers have linked automatic machine tools to perform a continuous series of operations. Less labor is required because the parts or pieces being machined are not handled manually. For example in an automated engine plant, a rough engine block goes through hundreds of different cutting, drilling, and grinding operations using little direct manual labor. The engine block is moved through work stations mechanically and is machined automatically by a battery of machine tools. Much of the inspection is automatic. Workers watch control panels for interruptions in the machines' normal functioning.

Other Metalworking Occupations. Large numbers of workers are employed in other metalworking occupations. These include punch press operators who run presses varying in size from small presses used to form brackets, clips, or other small parts, to massive presses which form, trim, and punch holes in automobile doors, body panels, and frames.

Automobile plants employ thousands of welders to join metal parts. Some manual electric-arc welders and gas welders work in production jobs in parts and body manufacturing plants, and others work in maintenance jobs repairing and rebuilding machinery and equipment. Machine (resistance) welders are employed on assembly lines to weld separate parts of bodies and subassemblies.

Foundry Occupations. Castings for automobile parts such as engine blocks are produced by pouring metal into molds where it cools and hardens in the shape of the molds. Patternmakers make a wood or metal pattern in the shape of the final casting desired. Coremakers shape the bodies of sand, or "cores," which are placed inside molds to form hollow spaces needed in castings. Machine molders make the sand mold into which the metal is poured.

Melters operate electric furnaces and cupolas used to melt metal for castings. The actual pouring is done by metal pourers. After the casting cools, shakeout men remove it from the mold. Other workers clean the castings and remove excess metal.

Forging Occupations. Parts which must withstand great stress, such as axles, are shaped by forging hammers and presses in the forge shop. Hammermen operate drop hammers which pound metal into various shapes between closed dies. The hammermen are assisted by heaters who heat the metal stock in a furnace to prepare it for forging and then pass the stock to the hammermen. Other forge shop workers are engaged in cleaning, finishing, heat treating, or inspecting forgings.

Inspection Occupations (D.O.T. 806.281; 283; 381; 382; 387; 684 and 687). Automobiles can be mass-produced because parts and subassemblies for the same make of automobile are interchangeable. These parts are made to exact measurements and are subject to close quality control and inspection. The industry employs statisticians and engineers in quality control departments who use statistical techniques designed to control product quality.

Inspectors check incoming raw materials, examine parts during the manufacturing stages, and make quality and conformity checks during the subassembly and assembly operations. Micrometers, specially designed gauges, and other measuring and testing instruments are used by inspectors and testers.

Assembling Occupations (D.O.T. 806.887). Assemblers, who make up the largest occupational group in the automobile industry, put together small parts to form subassemblies, and subassemblies to form the complete motor vehicle (line assemblies). Most assembly jobs are repetitive and require little skill; however, they do require coordination and may be strenuous. Each employee is assigned a job to be done when the vehicle passes his work station. For example, one employee may start nuts on bolts and the next worker may tighten the nuts.

Finishing Occupations. Many finishing operations must be performed as the vehicle is assembled. For example, metal surfaces must be readied for finishing, exteriors painted, interiors covered, and seats upholstered. *Metal finishers* (D.O.T. 705.884) file and polish rough surface areas of metal parts in preparation for painting. *Platers* (D.O.T. 500.885) put a thin coat of chrome on bumpers and on other parts such as grills, mirrors, and hubcaps. *Sprayers* (D.O.T. 741.887) operate spray guns to apply paint or other finishes to the metal parts. *Polishers* (D.O.T. 705.884) rub the finished surfaces by hand or polish them with a portable motor-driven buffing wheel.

Cutters, sewing machine operators, and trimmers combine their skills to provide comfortable and attractive interiors. With hand shears or an electric knife, the *cutter* (D.O.T. 781.884) cuts fabric or leather to the specific shape according to a pattern. The *sewing machine operator* (D.O.T. 787.782) sews together the upholstery sections. *Trimmers* (D.O.T. 780.884) arrange and fasten springs and padding or foam rubber for the seats and other upholstered areas, and install the covering material.

Materials Handling, Custodial, and Plant Protection Occupations. The assembly-line production process requires an elaborate system of materials movement to supply the lines and to move finished products. Power truck operators deliver parts and subassemblies to the line or move materials between plants. Materials handlers load and unload parts from trucks or containers. Overhead crane operators use machines to move raw steel stock, heavy dies, and other materials that cannot be lifted by hand.

Many employees are needed to keep the production workers supplied with tools, parts, and materials, and to keep records of materials. Factory clerks, such as checkers, stock chasers, and stock clerks, coordinate the delivery of parts to the proper location on the assembly line. They check, receive, and distribute materials and keep records of incoming and outgoing shipments.

The industry also employs many workers in plant protection and custodial work. These include plant patrolmen, gatemen, janitors, and porters.

Maintenance Occupations. A large staff is required to keep machines and equipment in good operating condition and to make changes in the plant layout. The maintenance and repair of complex electrical, electronic, and hydraulic equipment require well-trained electricians, electronic technicians, and maintenance mechanics. Millwrights move and install heavy machinery and equipment. Plumbers and pipefitters lay out, install, and repair piping, valves, pumps, and compressors. Other maintenance employees include carpenters, stationary engineers, and sheet metal workers.

Training, Other Qualifications, and Advancement

The training requirements for jobs in the motor vehicle industry range from a few hours of on-the-job training to years of preparation. Many plant workers can learn their jobs in a day or two. On the other hand, engineering and scientific jobs, as well as craft and technical jobs, require many years of training.

The minimum requirement for professional engineering jobs is a bachelor of science or a bachelor of engineering degree. Advanced degrees often are necessary for scientists, particularly those engaged in research and development. Newly hired engineers and scientists often are offered specialized training courses. Many of the industry's top executives have been selected from this professional group.

The requirements for other technical employees vary according to their specialities. For example, many engineering aids, laboratory assistants, and draftsmen are technical institute or junior college graduates. Some firms train their technical employees at company-run schools, or subsidize students at local junior colleges or technical institutes. These employees also may take advanced training and acquire engineering degrees.

Although a college education is not always required, administrative positions are often filled by men and women who have degrees in business administration, marketing, accounting, industrial relations, or similar fields. Some companies have advanced training programs for employees in these specialties.

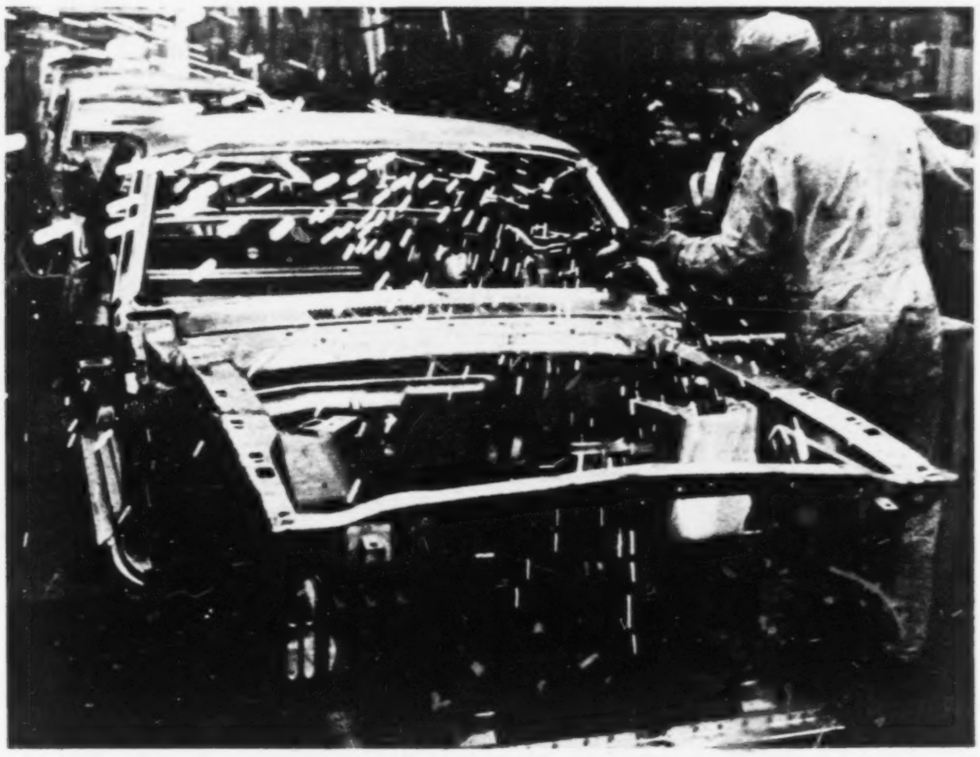
Most motor vehicle firms hire people who have had commercial courses in high schools or business schools for office jobs such as keypunch operator and typist. These people usually have not been trained specifically for jobs in this industry.

Applicants for most plant jobs must be in good physical condition and have an aptitude for mechanical work. For semiskilled jobs, the industry seeks employees who can do routine work at a fast pace. Most assembly jobs can be learned in a few hours or days. Some of the less skilled machine operating jobs can be learned in a few weeks.

Extensive training periods are required for craft jobs in the motor vehicle industry. Tool and die makers, patternmakers, electricians, millwrights, and machinery repairmen are some of the highly skilled workers who generally need at least 4 years of training before they can perform their specialized jobs. Although many craft workers acquire their skills by working with experienced workers, apprenticeship generally is the best way to learn a skilled trade. Automobile firms, in cooperation with labor unions, conduct apprenticeship programs for many skilled trades.

Applicants for apprenticeship training are often required to be high school, trade, or vocational school graduates. Young people interested in apprenticeship training should prepare themselves by taking courses in mathematics and science. Apprentice applicants must take physical examinations, mechanical aptitude tests, and other qualifying tests.

Apprenticeship training includes both on-the-job and classroom in-



Worker spot welds paneling on automobile body.

struction. Mathematics, blue print reading, shop theory, and specialized subjects are studied in the classroom, and the operation and use of tools and machinery are learned in the shop.

Most foremen are selected from workers already employed. Frequently, people who have completed apprenticeship training and acquired further experience become supervisors. Successful applicants go through a training period after promotion.

In a large number of cities, training programs are in operation under the Manpower Development and Training Act for many of the production, clerical, and technical occupations discussed earlier. These programs, which are for unemployed and underemployed workers, may last up to a year. Some occupations may require additional on-the-job or apprenticeship training.

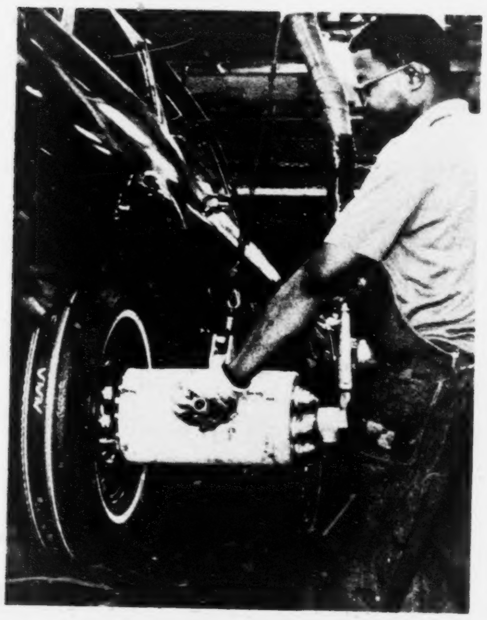
Employment Outlook

The motor vehicle industry will provide thousands of openings annually during the 1970's, mainly to replace workers who retire, die, or transfer to other industries. Production of motor vehicles and parts, and therefore employment, have fluctuated sharply since the end of World War II because of the industry's sensitivity to changes in general business conditions, consumer preferences, availability of credit, and defense production needs. For example, in 1970 employment averaged 810,000 or 13 percent below the 1969 level of 914,000.

In the future, assuming a high rate of economic growth, the demand for motor vehicles and equipment is expected to increase substantially. Factors that will stimulate demand include increases in population and personal income, growth of multicar ownership, a continuing shift of families from cities to the suburbs, and the need to replace vehicles that wear out. However, because of laborsaving technological developments, employment is not expected to keep pace with increases in production.

The industry's continued emphasis on mechanization and automation of production methods is expected to increase output per man-hour. Motor vehicle manufacturers increasingly are using computerized machines for assembly and machining operations. A recent laborsaving innovation is the "industrial robot" which is more versatile than conventional automated equipment and can be adjusted to weld body panels, assemble parts, and do a variety of other tasks. New materials also are expected to increase output per man-hour. A recent example is the substitution of plastics for metal parts, which reduces the amount of labor needed for parts production and assembly, since plastic parts generally are molded in one piece and require fewer finishing operations. More efficient machining techniques such as electrical discharge machining are expected to be more widely used in the future. In addition, new and modernized plants incorporating the latest production-line materials handling and parts conveyor equipment should further efficiencies in production. Some of the increased efficiency, however, will be offset by the greater number of man-hours needed to produce a variety of models and to provide additional safety equipment and exhaust control devices.

The occupational distribution of employment in the industry has been changing as a result of emphasis upon research and development, and the increasing use of automatic manufacturing operations. Following recent trends, the number of engineers, scientists, and other professional and technical personnel is expected to increase because of expansion in research and development. Systems analysts and programers will be employed in greater numbers as the use of computers increases. Employment of clerical and administrative workers is expected to remain at about the present level. Although computers may reduce employment in some clerical occupations, a slight increase in the number of stenographers and typists is anticipated.



The employment of skilled workers, as a group, may decline very slightly. Although some skilled occupations, including millwright, pipefitter, and machinery repairman, are expected to increase, others, such as machinist, are expected to decline. The number of semiskilled workers is expected to remain relatively stable.

Earnings and Working Conditions

The earnings of production workers in this industry are among the highest in manufacturing. In 1970, they averaged $170.47 for 40.3 hours a week, or $4.23 an hour, compared with $133.73 for a 39.8 hour week, or $3.36 an hour for production workers in all manufacturing industries.

Average straight-time hourly earnings for several production occupations shown in the following table are based on a survey of motor vehicle and motor vehicle parts manufacturers in early 1969. Earnings vary according to size of firm and geographic location, particularly in parts manufacturing.

Occupation	*Average Hourly Earnings*	
	Motor vehicles	*Motor vehicles parts and accessories*
Assemblers	$3.60	$3.03
Tool and die makers	4.91	4.32
Punch press operators	3.62	3.33
Resistance welding operators	3.67	3.31
Machine tool operators, production	3.64	3.55
Machine tool operators, toolroom	4.76	4.34
Heat treaters	3.58	3.51
Inspectors	3.67	3.38
Maintenance mechanics	4.79	4.04
Power truck operators	3.57	3.26
Custodians	3.37	3.03

In addition to wages and salaries, employees receive a wide range of benefits, most of which are paid for entirely by employers. These include life insurance; accidental death and dismemberment benefits; and hospitalization, surgical, and medical benefits.

Most employees also receive paid vacations (or payments in lieu of vacations) and an average of 12 paid holidays a year. Most companies provide regular annual wage increases as well as automatic increases when the cost of living rises. Employees are paid at one and one-half their normal rate for working more than 40 hours a week or for working on Saturdays. They receive premiums for working late shifts and double the hourly rate for Sundays or holidays.

Most workers are covered by supplemental unemployment benefit plans paid for solely by the employers. These plans also provide supplementary pay (short workweek benefits) to help stabilize the income of hourly rated employees and some salaried employees when they are required to work less than a normal week. In addition, during layoff, provisions are included for hospitalization, surgical, drug and medical benefits; life and accident insurance; survivor income benefit coverage; separation payments for those laid off 12 continuous months or more; and relocation allowances.

A great majority of the motor vehicle workers are covered by company-paid retirement plans. Retirement pay varies with length of service. Many of these plans include provisions for retirement as early as age 55, or after 30 years of service regardless of age.

Usually within 40 days of their hiring date, most hourly rated workers and some salaried workers in the industry are required to join a union. Most production and maintenance workers in assembly plants, and a majority employed in parts plants, belong to the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America. In some parts of plants, the International Union, Allied Industrial Workers of America is the bargaining agent for the employees. Other unions with membership in the industry include the International Association of Machinists and Aerospace Workers; the Pattern Makers' League of North America; the International Molders' and Allied Workers' Union of North America; the Metal Polishers, Buffers, Platers and

Helpers International Union; the International Union, United Plant Guard Workers of America (Ind.); the Mechanics Educational Society of America; the International Brotherhood of Electrical Workers; and the International Die Sinkers' Conference (Ind.).

Most motor vehicle workers are employed in plants which are relatively clean and free from dust, smoke, and fumes. Some work surroundings, however, particularly in the foundry and forge departments, may be hot and the worker may be exposed to noise, dust, and fumes. Working conditions in foundries and forge departments have been greatly improved by the introduction of larger, more efficient ventilation systems.

Motor vehicle plants are, on the whole, comparatively safe places to work, although safety conditions vary somewhat among the individual departments or facilities. The rate of disabling injuries in motor vehicle plants has been less than half that of all manufacturing industries in recent years. Some plants have fully equipped hospital facilities with doctors and nurses in attendance.

Sources of Additional Information

Further information on employment and training opportunities in motor vehicle manufacturing can be obtained from local offices of the State employment service; personnel departments of individual motor vehicle manufacturing firms; locals of the labor unions noted above; and from:

International Union, United Automobile, Aerospace and Agricultural Implement Workers of America, 8000 East Jefferson Ave., Detroit, Mich. 48214.

Automobile Manufacturers Association, Inc., 320 New Center Building, Detroit, Mich. 48202.

OFFICE MACHINE AND COMPUTER MANUFACTURING OCCUPATIONS

During the last decade, employment in the office machine and computer industry grew four times faster than employment in manufacturing as a whole. Growth was spearheaded by a rapid expansion in the production of electronic computers. For many years, the industry's chief products were typewriters, adding machines, calculators, and other conventional office machines. The production of computers did not begin until after World War II, and as late as 1953 only a small number of them had been produced. Today, plants that make computers account for more than half of the industry's production.

Nature and Location of the Industry

In 1970, the office machine and computer manufacturing industry employed about 285,000 men and women in approximately 700 plants. Two-thirds of them worked in plants that produce computer equipment, and the remainder, in conventional office machines, including scales and other weighing devices.

Computer equipment manufacturing plants employed 190,000 workers in 1970. These plants manufacture general purpose computers as well as those used for special applications, such as space exploration and missiles. They also manufacture peripheral equipment. Examples include machines that read magnetic numbers, such as those on bank checks, and storage devices, for future reference.

In addition to computer and peripheral equipment, plants in this industry may furnish "software" (computer programs and operating systems). Thousands of people whose employment is not included in this chapter are employed outside manufacturing plants by firms that specialize in software or that rent or lease computers and provide related services.

In early 1970, more than 90,000 people were employed in factories that produced conventional office machines and scales; about 40,000 produced desk calculators, cash registers, coin and ticket counters, and adding, accounting, and voting machines; about 25,000 produced miscellaneous office machines, including items as diverse as postage meters and dictating machines; nearly 20,000 produced typewriters; and fewer than 7,000 made industrial and household scales and other weighing devices.

Large plants account for most of the employment in office machine and computer manufacturing. About three-fourths of the industry's employees are in plants that have 1,000 or more employees, but several computer plants have more than 5,000 employees.

New York, California, and Minnesota have more than two-thirds of the computer manufacturing employment, and the following States account for most of the remainder: Massachusetts, Pennsylvania, Arizona, Florida, and Colorado. In New York, the lower Hudson River Valley area has many important computer manufacturing centers: Poughkeepsie, East Fish Kill, and Kingston. Large manufacturing plants also are located in Rochester and Utica, N.Y., and in the Boston, Mass., and Philadelphia, Pa. areas. The leading center in the Midwest is Minneapolis-St. Paul. The Los Angeles industrial area is the most important computer manufacturing center in the West, followed by Pheonix, Ariz., and San Jose, Calif.

The following States account for more than four-fifths of the employment in plants manufacturing conventional business machines and scales: Ohio, New York, Connecticut, Illinois, Michigan, California, and Kentucky. The following areas are some of the important manufacturing centers: Dayton, Toledo, and Euclid. O.; the New York-Northeastern New Jersey industrial area; Hartford and Stamford, Conn.; Chicago, Ill.; Detroit, Mich.; and Lexington, Ky.

Occupations in the Industry

A wide variety of occupations, requiring a broad range of training and skills, are found in plants manufacturing office machines and computers. About half of the industry's workers are in white-collar jobs (engineering, scientific, technical, administrative, sales, and clerical); the other half are in plant jobs (assembly, inspection, maintenance, transportation, and service).

Because of its complex nature, white-collar workers represent a significantly larger proportion of total employment in the computer industry than in most other manufacturing industries. In manufacturing as a whole, white-collar workers represent less than one-third of total employment.

Nearly three-fourths of the industry's employees are men. Women employees are concentrated in clerical, assembly, and inspection occupations, although some women work in nearly all types of jobs.

Some of the key occupations in this industry are described briefly. (Detailed discussions of professional, technical, skilled, and other occupations found in the office machine and computer industry, as well as in many other industries, are given elsewhere in this *Handbook,* in sections covering individual occupations.)

Engineering and Scientific Occupations. Nearly 1 out of every 10 workers in the office machine and computer industry is an engineer or scientist—a much greater proportion than in most industries. Most of them work in computer plants.

The largest group of engineers work with electricity or electronics. Most of them are engaged in research and development, although many work in production, in fields such as quality control. The industry also employs large numbers of mechanical and industrial engineers. Some mechanical engineers are engaged in product development and tool and equipment design. Others are concerned with the maintenance, layout, and operation of plant equipment. Industrial engineers determine the most effective means of using the basic factors of production—manpower, machines, and materials.

Mathematicians make up the largest group of scientists in office machine and computer manufacturing. They work with engineers on complex mathematical problems, for example, in the design of computers. Physicists are employed in research and development work in connection with items such as miniaturized components and circuits. Statisticians work in fields such as quality control and production scheduling.

The industry also employs systems analysts and computer programmers, many of whom have scientific or engineering backgrounds. Systems analysts primarily divise new techniques and improve existing techniques. Programmers design and test new computer programs. Some systems analysts and programmers specialize in scientific and engineering problems, while others process accounting, inventory, sales, and other business data. Systems analysts and programmers may assist salesmen in determining data processing needs of customers.

Technical Occupations. More than 1 out of every 10 workers in the industry is a technician. Most of them are electronics specialists who assist engineers and scientists in research and development, test and inspect electronic components, and do highly complex assembly work. Some electronics technicians specialize in repairing computers. Chemical control technicians prepare solutions used in the etching of circuit boards. Photographic technicians set up light beams and other equipment used in the tracing process to create copper etchings on circuit boards. Draftsmen prepare drawings from sketches or specifications furnished by engineers. Engineering aids assist engineers by making calculations, sketches, and drawings, and by conducting performance tests on components.

Administrative and Sales Occupations. About 1 out of every 10 workers is an administrator. Included are top executives who manage companies and determine policy

Electronic technicians debug computer and peripheral equipment.

decisions, and middle managers who direct departments such as advertising and industrial relations. Other administrative employees in staff positions include accountants, lawyers, and market researchers.

Sales personnel hold about 1 out of every 25 jobs in the industry. Salesmen of conventional office machines usually work on their own. Computer salesmen, on the other hand, are assisted by a host of technical experts, such as engineers and systems analysts. Because the computer is complex and expensive, the computer salesman may have to spend several months to complete a sale.

Clerical Occupations. Nearly 1 out of every 6 workers in the industry is in a clerical job. Included in this group are secretaries, clerk-typists, file clerks, bookkeepers, and business machine operators, as well as computer personnel such as keypunch operators and console operators.

Plant Occupations. Half of the office machine and computer manufacturing industry employees are plant (blue-collar) workers. Most plant workers are engaged directly in making computers and office machines. Included in this group are assemblers, inspectors or testers, machinists, machine tool operators, and the foremen who supervise these workers. Truckdrivers, material handlers, power truck operators, guards, and janitors move materials and perform custodial duties. In addition, plumbers and pipefitters, electricians, carpenters, and other workers maintain production machinery and building facilities.

Assembly Occupations. (D.O.T. 590.885; 692.782; 706.884; 726.781 and .884.) Workers who assemble computers and office machines have many different skills and make up the largest group of plant workers. Most of them are semiskilled.

Assemblers may put together small parts to form components or components to form the finished product. Hand assembly is needed for many operations. Some hand assemblers do a single operation as components move down the assembly line. The assembly of typewriters, for example, is divided into many simple operations. Each assembler is assigned a job to do as the typewriter passes the work station. Some assembly jobs are difficult and require great skill. Electronics assemblers, for example, use schematic diagrams as guides to wire complex memory and logic panels for computers.

Electronic technicians usually do the most difficult hand assembly work. In research laboratories, they put together complex experimental equipment. In the plant, they assemble those items the operation of which requires a knowledge of electronics theory.

Tools which assemblers use depend on their job and the products on which they work. Screw drivers, pliers, snippers, and soldering irons are common. They use special devices to position and hold parts during assembly. Precision equipment may be used to weld connections in circuit assemblies.

Machines do many assembly operations. For example, automatic machines form cores from chemical mixtures. These are used in computer memory panels. In making circuit boards, automatic machines position components on the boards and solder connections. Automatic wire-wrapping machines wire panels and plugboards. To make sure the machines are functioning properly, semiskilled operators feed the machine and remove and inspect finished items.

Machining Occupations. Most office machine and computer manufacturing plants employ metal machining workers. Machine-tool operators and machinists operate power-driven machine tools to produce metal parts for computers, typewriters, accounting machines, calculators, and other products. Numerical control machine operators tend machines that have been programmed to perform machining operations automatically. Toolmakers construct and repair jigs and fixtures used in the fabrication and assembly of parts. Diemakers specialize in metal forms (dies) for punch and power presses to shape metal parts.

Inspection and Testing Operations. When raw materials enter the plants, testing and inspection of office machines and computers begins and continues throughout operations. Finished components and products are tested and inspected thoroughly.

Some inspectors examine individual parts; others inspect components during fabrication and subassembly; still others inspect completed office machines and computers. Many jobs require highly skilled workers. On the other hand, relatively unskilled people can run some automatic equipment, which not only checks the component or assembly under test, but may run simultaneous checks on itself. Workers who feed or monitor automatic test equipment are called test-set operators or testing machine operators.

Job titles indicate the work many inspectors do. *Machined parts inspectors* (D.O.T. 609.381) use precision testing instruments to determine whether parts have been machined properly to conform to blueprint specifications. *Type inspectors* (D.O.T. 706.687) examine typewriter type under magnifying glass for defects such as burrs and incomplete or off-center characters. *Electronic subassembly inspectors* (D.O.T. 726.384) use continuity meters and measuring devices such as calipers and micrometers to examine computer circuits and other electronic subassemblies. *Electronic assembly inspectors* (D.O.T. 722.281) use frequency meters and other instruments to test electronic systems such as computer memory units.

In plants that manufacture conventional office machines, such as typewriters and adding machines, final inspection is relatively simple. Inspectors operate the machines, look for defects, and refer malfunctioning machines to repairmen. The final inspection or "debugging" of computers, on the other hand, is very complex. Electronic technicians inspect new computers under the supervision of electronic engineers. They use oscilloscopes and other devices to run tests and schematic drawings to locate causes of malfunctions. Performances of new computers are checked against performances of computers already in operation.

Maintenance Occupations. Many maintenance workers with different types of training take care of machinery and equipment. Skilled electricians are responsible for the proper maintenance of electrical equipment. Machine and equipment repairmen make mechanical repairs. Maintenance machinists and welders build and repair equipment and fixtures. Air-conditioning and refrigeration mechanics are employed in plants which are air-conditioned and have special refrigerated and dust-free rooms. Painters, plumbers, pipefitters, carpenters, sheet-metal workers, and other building maintenance craftsmen also are employed in office machine and computer plants.

Other Plant Occupations. Employed in materials movement and handling are operators of plant trucks and tractors; forklift operators who stack crates and load and unload trucks and boxcars; and truckdrivers who handle transportation outside the plant. Other occupations include boiler operator and stationary engineer, plant guard, and janitor.

Training, Other Qualifications, and Advancement

A bachelor's degree in engineering or one of the sciences is usually the minimum requirement for engineering and scientific jobs. For research and development work, applicants with advanced degrees generally are preferred. Some companies have formal training programs designed to give young college graduates a broad picture of manufacturing operations before they are assigned to a particular department. Because of the highly technical nature of computers, many of the industry's executives have backgrounds in engineering or science.

Engineers and scientists, as well as graduates of business administration and liberal arts colleges, are employed as salesmen, programmers, and systems analysts. However, most business and liberal arts graduates are employed in accounting, labor-management relations, and other administrative activities.

Technicians qualify for their jobs in a number of ways. Some have attended either a public, private, or Armed Forces technical school. Others have had 1 or more years of scientific or engineering training, but have not completed all of the requirements for a degree. Technicians may be promoted from lower grade jobs in the plant. A few well-qualified technicians have advanced to engineering jobs, after completing courses in mathematics, engineering, and related subjects.

People who have completed commercial courses in high school or business school are trained in clerical jobs such as stenographer or office machine operator. For computer console operators, most firms prefer to hire people who have some college or technical training in data processing. With additional training, clerical workers can advance to programmer jobs.

In selecting workers for plant jobs, firms generally prefer high school or vocational school graduates. Training varies from a few days to years of on-the-job instruction and experience. Skilled inspectors and craftsmen, such as machinists and tool and die makers, may spend 3 to 4 years in learning their jobs. Frequently, openings for skilled jobs are filled by qualified young workers already in the plant. Some firms have formal apprenticeship programs, which include both on-the-job training and classroom instruction related to the particular craft. For example, a machinist apprentice would study blueprint reading, mechanical drawing, shop mathematics, physics, and other subjects.

Workers who have little or no previous experience or training are hired for less skilled inspection, assembly, and machining jobs. Applicants may have to pass aptitude tests and demonstrate ability for particular types of work. Most assembly and inspection jobs require good vision and color perception, manual dexterity, and patience. Inexperienced workers receive on-the-job training, usually ranging from a few days to several weeks. In addition, some plants conduct classroom training of short duration.

Experienced plant workers can advance to higher grades. Assemblers can become semiskilled inspectors, and eventually skilled inspectors. Machine tool operators can move to skilled machinists. Craftsmen and skilled inspectors can become technicians, after completing courses in company-operated schools, junior colleges, or technical schools. Foremen jobs are open to well qualified plant workers who have supervisory ability.

Employment Outlook

During the 1970's employment in this industry is expected to rise rapidly and create several thousand new jobs each year. Additional openings will result from the need to replace experienced workers who retire, die, or transfer to other fields of work.

Employment growth is expected to be concentrated in plants producing electronic computer equipment. A rapid increase in the demand for computers is anticipated during the 1970's. As the economy expands and becomes more complex, computers will become increasingly useful to business, government agencies, and other organizations. Demand also will be stimulated as new uses for computers are developed.

Growth in the number of computers will be accompanied by a need for additional peripheral equipment—input and output, storage, and communication devices. Much of the peripheral equipment is used for computer time sharing—the multiple use of a large central computer via remote control terminals located at a desk or in a laboratory—to make computer technology available to small organizations. Time sharing is expected to expand rapidly into areas such as hospital administration and education. A growing number of small businesses, laboratories, schools, and other organizations also are expected to buy or lease "mini-computers." Introduced in the late 1960's, these relatively inexpensive small units also are being used by large organizations to control manufacturing processes and screen and prepare data before it is fed into large computers.

Employment in plants producing conventional office machines is expected to grow slowly. Most job openings will result from the need to replace experienced workers who retire, die, or transfer to other fields of work. The demand for most types of office machines is expected to rise rapidly during the 1970's, as business and government organizations grow and the volume of paperwork increases. However, Japanese and European imports have been gaining a greater share of the domestic office machinery market and this trend may continue. Moreover, technological improvements in production methods are expected to increase output per worker. For example, increasing mechanization of operations formerly done by hand will tend to reduce labor requirements, particularly in plants where products are mass-produced, such as typewriters and calculators.

Some occupational groups in the office machine and computer manufacturing industry are expected to grow faster than others. For example, the number of professional and administrative workers particularly engineers, scientists, technicians, systems analysts, and programers, is expected to increase more rapidly than the number of clerical and plant workers. Demand for these workers will be spurred by continued high levels of research and development expenditures to improve production processes, advance machine capabilities, and broaden the use of computers.

Secretaries, stenographers, typists, and computer operating personnel will account for most of the growth in clerical occupations. More extensive use of computers in routine paperwork may result in a decline in the employment of bookkeepers and file clerks.

Semiskilled production workers, such as assemblers and inspectors, are expected to account for most of the increase in plant occupations despite the growing use of automated and mechanized assembly line equipment. However, employment of maintenance and repair workers to keep this equipment in good working order will increase more rapidly than employment of semiskilled production workers.

Earnings and Working Conditions

Earnings of plant workers in the office machine and computer industry are higher than the average for other manufacturing industries. In 1970, their earnings averaged $152.11 a week, or $3.71 an hour compared with $133.73 a week, or $3.36 an hour, for plant workers in manufacturing industries as a whole.

National wage data are not available for individual occupations in the office machine and computer industry. However, the following tabulation, based on data obtained from a small number of union-management contracts, provides an example of the range in hourly wage rates for selected occupations in 1969–70.

Assemblers	$2.11–3.37
Inspectors	2.11–3.83
Maintenance workers	2.71–3.83
Machinists and machine tool operators	2.58–4.01
Electronics technicians	3.12–4.63

Some employees work night shifts and weekends because many plants operate around the clock. Employees working second or third shifts or more than 8 hours a day or 40 hours a week generally receive extra pay.

Paid vacations and holidays are almost universal in this industry. Most employees receive 1 to 4 weeks of vacation, depending on length of service. Most employees also receive insurance and pension benefits at least partially financed by the employer, including life, sickness, accident, hospitalization, and surgical benefits. Employee stock purchase plans are in effect in many firms.

In general, the work surroundings in office machine and computer plants are more favorable than those in most other types of manufacturing plants. Work stations usually are well-lighted and clean, and free from dust, fumes, and loud noises. Many computer factories are relatively new and are located in suburban areas.

Some plant jobs are repetitious, but very few require great physical effort. Office machine and computer manufacturing has fewer and less severe injuries than the average for all manufacturing.

Many plant workers are covered by labor-management contracts. The principal unions in this industry are the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Union of Electrical, Radio and Machine Workers; and the International Brotherhood of Electrical Workers.

Where To Go For Additional Information

Business Equipment and Manufacturers Association, 1728 L Street, NW., Washington, D.C. 20006.

American Federation of Information Processing Societies, Inc., 210 Summit Avenue, Montvale, N.J. 07645.

OCCUPATIONS IN THE PAPER, AND ALLIED PRODUCTS INDUSTRIES

In 1970, the paper and allied products industry employed approximately 710,000 people to produce many different kinds of paper and paperboard products. The industry employs workers in occupations ranging from unskilled to highly specialized technical and professional jobs, many found only in the paper industry.

About 150,000 women were employed in this industry in 1970. Many worked in plant jobs, mainly as machine operators and inspectors in paper finishing and converting plants; others worked in office jobs. Few women were employed in the actual production of pulp and paper.

Nature and Location of the Industry

The paper industry is highly mechanized. Pulp, paper, and many finished paper products are manufactured by machines—some as long as a football field—in a series of nearly automatic operations that require very little handling of materials by workers. Manufacturing plants in the paper industry are engaged in one or more of three different operations. The production of pulp (the basic ingredient of paper) from wood, reused fibers, or other raw materials; the manufacture of paper or paperboard (thick paper) from pulp; or the conversion of rolls of paper or paperboard into finished products.

The largest group of employees in the industry in 1970 worked in mills that produced pulp, paper, or paperboard. The next largest group was employed in plants that produced paperboard boxes and containers; the remainder worked in plants that produced a variety of other paper products.

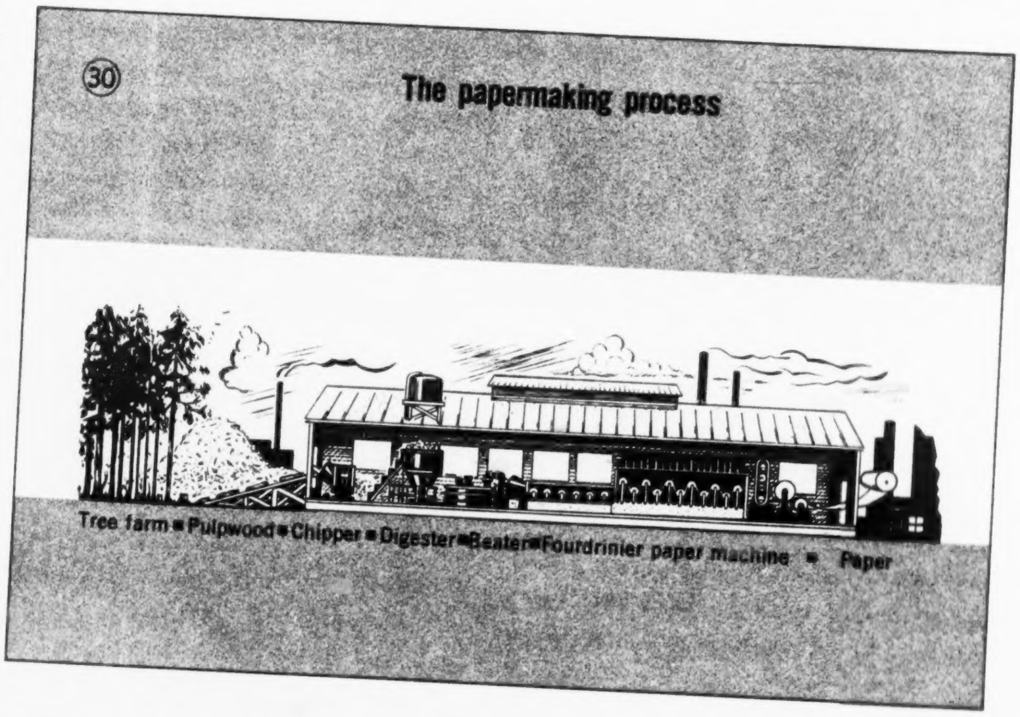
More than 80 percent of the industry's employees worked in factories employing 100 workers or more.

Workers in this industry are located throughout the country, although about half are employed in eight States: New York, Pennsylvania, Ohio, Illinois, Wisconsin, Massachusetts, New Jersey, and California. Other States having large numbers of paperworkers are Michigan, Georgia, Washington, Maine, Florida, Texas, North Carolina, and Alabama.

Occupations in the Industry

Workers in the paper industry are employed in a wide variety of occupations, requiring a broad range of training and skills. Many workers operate and control specialized papermaking, finishing, and converting machines. Some workers install and repair papermaking machinery, converting equipment, pumps, and measuring instruments. Truck drivers make deliveries to and from plants, and other workers load and unload trucks, railroad cars, and ships. Guards, watchmen, and janitors do custodial work. Other workers keep inventory records of stock and tools.

The industry employs many workers in clerical, sales, and administrative occupations. For example, it employs purchasing agents, personnel managers, salesmen, office clerks, stenographers, bookkeepers, and business machine operators. Also, because of the complex processes and equipment used, the industry employs many professional and technical workers, including chemical and mechanical engineers, chemists, laboratory technicians, and pulp and paper testers. (Detailed discussions of professional, technical, and mechanical occupations, found not only in the paper industry but in other industries, are given elsewhere in the *Handbook* in sections cover-


㉚ The papermaking process

Tree farm ■ Pulpwood ■ Chipper ■ Digester ■ Beater ■ Fourdrinier paper machine ■ Paper

ing individual occupations. See index for page numbers.)

Production Jobs. More than three-fourths of all employees in the industry in 1970 worked in production jobs. The simplified description of papermaking occupations and processes that follows applies to a plant which combines the production of pulp, paper, and finished paper products into one continuous operation. (See chart 30.)

After pulpwood logs are received at the pulp mill, the bark is removed. One machine used for this operation is a large revolving cylinder known as a "drum barker." Logs are fed mechanically into this machine by a semiskilled worker called a *barker operator* (D.O.T. 533.782). The machine cleans bark from the logs by tumbling them against each other and also against the rough inner surface of the drum. Next, pulp fibers in the logs are separated from other substances not used in papermaking. This is done by a chemical or mechanical process, or both, depending on the type of wood used and the grade of paper desired.

In the mechanical process, pulpwood is held against a fast-revolving grindstone that separates the fibers. In the more commonly used chemical process, pulpwood is carried on conveyor belts to a chipper machine operated by a *chipperman* (D.O.T. 668.885). The machine cuts the pulpwood into chips about the size of a quarter. These wood chips are "cooked" with chemicals under high temperature and pressure in a "digester," a kettlelike vat several stories high. The digester is operated by a skilled worker called a *digester operator* (D.O.T. 532.782). He determines the amount of chemicals to be used and the cooking temperature and pressure; he also directs the loading of the digester with wood chips and chemicals. By checking an instrument panel, he makes certain that proper conditions are being maintained. When the pulp fibers are removed from the digester, they are washed to remove chemicals, partially cooked chips, and other impurities. These fibers, called pulp, resemble wet, brown cotton.

To turn pulp into paper, the pulp is mixed thoroughly with water and further refined in a machine operated by a skilled worker called a *beater engineer* (D.O.T. 530.782). The kind and amount of chemicals and dyes he uses and the length of time he "beats" the solution determines the color and strength of the paper.

The pulp solution, now more than 99 percent water, is turned into paper or paperboard by machines which are among the largest in American industry. The machines are of two general types. One is the Fourdrinier machine, by far the most commonly used; the other is the cylinder machine used to make particular types of paper such as building and container board. In the Fourdrinier, the pulp solution pours into a continuously moving and vibrating belt of fine wire screen. As the water drains, millions of pulp fibers adhere to one another, forming a thin wet sheet of paper. After passing through presses that squeeze out more water, the newly formed paper passes through the dryer section of the papermaking machine to evaporate remaining water.

The quality of the paper produced largely depends on the skill of the *paper machine operator* (D.O.T. 539.782). His principal responsibility is to control the "wet-end" of the papermaking machine, where paper of a specified thickness, width, and physical strength is formed. He checks control-panel instruments to make certain that the flow of pulp and the speed of the machine are coordinated. The paper machine operator also determines whether the paper meets required specifications by interpreting laboratory tests or, in

some instances, by visually checking or feeling the paper. He supervises the less skilled workers of the machine crew and, with their help, keeps the paper moving smoothly through the machine. The paper machine operator and his crew also may replace worn felts and wire screens. The *backtender* (D.O.T. 532.885), who is supervised by the paper machine operator, controls the "dry-end" of the papermaking machine, where paper is dried and prepared either for shipment or conversion into finished products. He controls the pressure and temperature of the rolls that dry and finish the paper and give it the correct thickness, inspects the paper for imperfections, and makes sure that it is being wound tightly and uniformly into rolls. The backtender also adjusts the machinery that cuts the rolls into smaller rolls and, with the help of assistants, may weigh and wrap the rolls for shipment.

Paper mills that produce a fine grade of paper for books, magazines, or stationery usually maintain finishing departments. Most workers in these departments are either semiskilled or unskilled. One semiskilled worker, the *supercalendar operator* (D.O.T. 534.782), aided by several helpers and by mechanical handling equipment, places huge rolls of paper onto a machine that gives the paper a smooth and glossy finish. He also inspects the finished paper to make sure that specifications have been met. Another semiskilled worker in the finishing department, the *paper sorter and counter* (D.O.T. 649.687), inspects sheets of paper for tears, dirt spots, and wrinkles, counts them, and may fill customer orders.

In converting plants, machines operated by semiskilled or skilled workers convert paper and paperboard into envelopes, napkins, corrugated shipping containers, and other paper products. Occupations in converting plants differ widely, depending largely on the product being manufactured. An example of a semiskilled worker in an envelope-making plant is the *envelope machine operator* (D.O.T. 641.885) who feeds and tends an automatic machine that makes envelopes from either rolls of paper or prepared envelope blanks. An example of a skilled worker in a converting plant is the *corrugator operator* (D.O.T. 643.782) who regulates the speed of the machine that glues together pieces of paperboard into corrugated paperboard used for shipping containers. Another of the few skilled workers in a converting plant is the *printer-slotter operator* (D.O.T. 651.782) who sets, adjusts, and operates a machine that cuts and creases corrugated or paperboard sheets and prints designs or lettering on them. He also positions the printing plates and cutting devices and turns keys to control the distribution of printing ink, pressure of rollers, and speed of the machine. Another skilled worker is the *die maker* (D.O.T. 739.381) who makes cutting dies used on machines that produce folding cartons (the familiar collapsible cartons used by clothing stores to pack purchases).

Converting plants employ thousands of workers to print text, designs, and lettering on paper products, such as cartons, bags, labels, wallpaper, and envelopes. Among these are skilled compositors who set type, and pressmen who prepare and operate printing presses.

Maintenance Jobs. The paper industry employs many skilled maintenance workers to care for its complex machinery and electrical equipment.

Millwrights install and repair machinery and equipment and examine paper machine rolls, bearings, and pumps to insure that they are in good working condition. They also take apart and reassemble machines and equipment when they are moved about the plant.

Instrument repairmen install and service electrical, electronic, and mechanical instruments that measure and control the flow of pulp, paper, water, steam, and chemical additives. The job of instrument repairman is becoming increasingly important with the greater use of automatic control equipment.

Other important maintenance employees include *electricians,* who repair wiring, motors, control panels, and switches; *maintenance machinists,* who make replacement parts for mechanical equipment; and *pipefitters,* who lay out, install, and repair pipes.

Stationary engineers are employed to operate and maintain powerplants, steam engines, boilers, air compressors, motors, and turbines.

Professional and Technical Occupations. The complexity of pulp and paper manufacturing requires thousands of workers who have engineering, chemical, or other technical training. Approximately 15,000 scientists and engineers and 7,000 technicians were employed by the paper industry in 1970.

Many *chemists* are employed to control the quality of the product by supervising the testing of pulp and paper. In research laboratories, chemists study the influence of various chemicals on pulp and paper properties. In addition, some chemists and engineers are employed as salesmen, supervisors of plant workers, or as administrators in po-

The quality of paper is tested by workers in the laboratory.

sitions requiring technical knowledge.

Chemical and mechanical engineers transform new pulp and papermaking techniques developed in the laboratory into practical production methods. Some chemical engineers are employed in plant jobs to supervise the production process.

Electrical engineers are employed to supervise the operation of electrical and electronic instruments and power-generating and distributing equipment.

Packaging engineers (D.O.T. 019.187) design and supervise the production of paper and paperboard containers and packages. A few box manufacturers also employ artists who develop letterings, designs, and colors for containers.

Professionally trained *foresters* manage large areas of timberland and assist in the wood-buying operations of pulp and paper companies. They map forest areas, plan and supervise the harvesting and cutting of trees, and seed or plant new trees to assure continuous production of timber.

Systems analysts and computer programers are becoming increasingly important to this industry. They analyze business and production problems and convert them to a form suitable for solution by automatic data-processing equipment.

Frequent tests are performed during the manufacture of pulp or paper to determine whether size, weight, strength, color, and other properties of the material meet specified standards. Some testing is done by machine operators, but in many mills testing technicians are employed. These employees, who have job titles such as *laboratory technician, paper tester, pulp tester, paper inspector*, and *chemical analyst*, work in plant laboratories. They use chemicals and laboratory testing equipment when performing tests. They also assist professional engineers and chemists in research and development activities. Depending on their training and experience, technicians may perform simple, routine tests or do highly skilled technical or analytical work.

Administrative, Clerical and Related Occupations. The paper industry employs many administrative, clerical, and other office personnel. Executives, many of whom are technically trained, plan and administer company policy. To work effectively, executives require information from a wide variety of personnel, including accountants, sales representatives, lawyers, and personnel employed in industrial relations, transportation, market research, and other activities. Bookkeepers, secretaries, shipping clerks, and other clerical workers keep records of personnel, payroll, inventories, sales, shipments, and plant maintenance.

Training, Other Qualifications, and Advancement

Training for new workers ranges from a few days to years. Many operating jobs can be learned in a few days of on-the-job training. On the other hand, maintenance jobs, some machine operating jobs, and, particularly, engineering and scientific jobs require years of specialized training.

Paper and pulp companies generally hire inexperienced workers for processing and maintenance jobs and train them on the job. Many companies prefer to hire high school graduates between the ages of 18 and 25. Production workers usually start as laborers or helpers and advance along fairly well-defined paths to more skilled jobs. Maintenance jobs generally are filled by men trained in the plant. When no qualified workers are available, however, jobs are filled by hiring experienced men from outside the plant.

Some large plants have formal apprenticeship programs for maintenance workers. Under these programs, which usually last 3 to 4 years, young men are trained for jobs such as machinist, electrician, millwright, and pipefitter. Generally, an applicant is given a physical examination, mechanical aptitude tests, and similar qualifying tests. Apprenticeship includes both on-the-job training and classroom instruction related to the occupation. For example, the machinist apprentice receives classroom instructions in mathematics, blueprint reading, shop theory, and specialized subjects. During shop training he learns the use and care of the tools of his trade.

A bachelor's degree from a recognized college is usually the minimum educational requirement for scientists, engineers, foresters, and other specialists. For research work, persons with advanced degrees are preferred. Many engineers and chemists (called *process engineers* and *paper chemists*) have specialized training in paper technology. A list of schools offering such training is available from the American Paper Institute, 260 Madison Ave., New York, N.Y. 10016. Many companies hire students specializing in papermaking for summer work, and upon graduation frequently hire them on a permanent basis. Some associations, colleges, universities, and individual companies offer scholarships in pulp and papermaking technology.

Some companies have formal training programs for college graduates having engineering or scientific backgrounds. These employees may work for brief periods in various plant operating divisions to gain a broad knowledge of pulp and paper manufacturing before being assigned to a particular department. Other firms immediately assign junior chemists or engineers to a specific research operation or maintenance unit.

Generally, no specialized education is required for laboratory assistants, testing technicians, or other kinds of technicians. Some employers, however, prefer to hire those who have had training in a technical institute or junior college. Training usually is given on the job. Laboratory assistants, for example, begin in routine jobs and advance to positions of greater responsibility after they have acquired experience and demonstrated ability to work with minimum supervision.

Administrative positions are filled frequently by men and women who have college degrees in business administration, marketing, accounting, industrial relations, or other specialized business fields. A knowledge of paper technology is helpful for administrative and sales occupations. This is true especially for sales jobs, where customers often require technical assistance. Most pulp and paper companies employ clerks, bookkeepers, stenographers, and typists who have had commercial courses in high school or business school.

Factors affecting advancement of plant workers include the length of time a worker has held a plant job, how well he performs his job, and his physical condition. Promotion generally is limited to jobs within a "work area," which may be a department, section, or an operation on one type of machine. To become a paper machine tender, for example, the worker may start as a laborer, wrapping and sealing finished rolls of paper as they come off the papermaking machine. As he gains experience and skill, he moves to more difficult assignments, finally becoming a machine tender in charge of operating a machine. These promotions may take years, depending on the availability of jobs. Experience gained within a work area usually is not transferable; unskilled or semiskilled workers who transfer to jobs outside their seniority area or to other plants usually must start in entry jobs.

Many plant foremen and supervisors are former production workers.

In some plants, qualified workers may be promoted directly to foreman or other supervisory positions. In others, workers are given additional training before they are eligible for promotion to higher level jobs. This training often is continued after the worker is promoted—through conferences, special plant training sessions, and sometimes by taking courses at universities or trade schools. Most firms provide some financial assistance for employees who take training courses outside their plant.

Employment Outlook

Employment in the paper and allied products industry is expected to increase slowly through the 1970's. Most job openings will stem from the need to replace experienced workers who retire, transfer to other fields of work, or die.

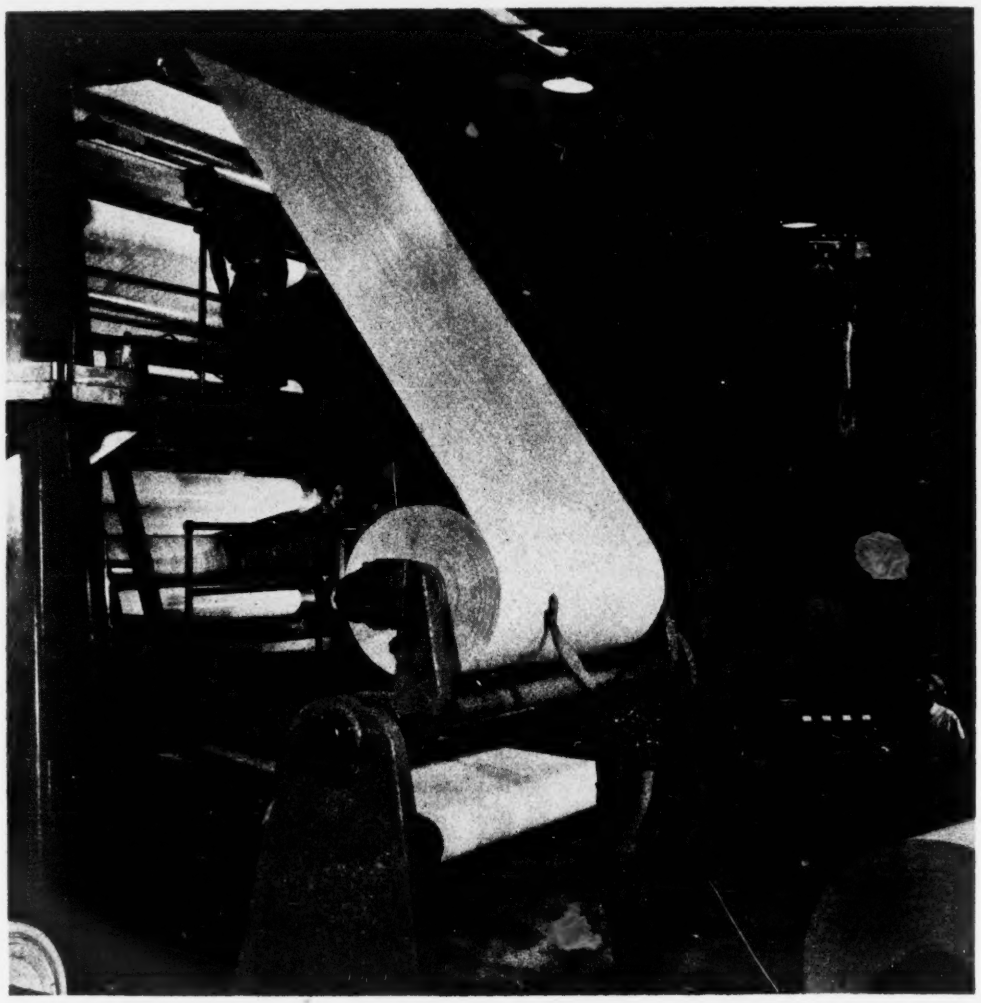
Production of paper is expected to increase substantially during the 1970's to meet increased demand resulting from population growth, business expansion, and new uses of paper. For example, rising population will create a greater demand for textbooks, writing papers, periodicals, and newspapers. Business expansion will increase the need for paper products such as business forms and packaging. The greater use of paper products such as disposable garments and refuse bags also is expected to stimulate production. Employment will increase at a slower rate than production, however, because of the increasing use of more efficient, laborsaving machinery and automatic control equipment.

Occupational groups in the industry are expected to increase at different rates. The numbers of engineers, scientists, technicians, and skilled workers, such as electricians and machinery repairmen, are expected to increase faster than other occupational groups in the industry. More scientific and technical personnel will be needed as research and development activities increase, and more skilled repairmen will be required to service the growing inventory of complex machinery. The employment of administrative and clerical workers also is expected to increase at a faster pace than total employment. On the other hand, employment of semiskilled workers will grow more slowly, while the number of helpers, laborers, and other unskilled plant workers is expected to remain about the same or decline slightly as more automatic machinery is introduced.

Earnings and Working Conditions

Production workers in the paper and allied products industry had average earnings of $3.44 an hour, or $144.14 for a 41.9 hour workweek in 1970. In the same year, earnings of production workers in all manufacturing industries averaged $3.36 an hour, or $133.73 for a 39.8 hour workweek.

The following tabulation, based on information obtained from a score of union-management contracts in the paper industry, illus-



Supercalendar operator checks paper finish.

trates the approximate range of hourly wage rates for selected production and maintenance occupations in 1970. Local wage rates within these ranges depend on geographic location, type and size of mill, kinds of machines used, and other factors.

Pulp plants	*Hourly rate ranges*
Woodyard and wood preparation occupations:	
Crane operator	$3.41–4.46
Barker, drum	3.27–4.15
Chipperman	2.87–4.03
Pulpmaking occupations:	
Digester operator (cook)	3.35–4.84
Grinderman	2.94–3.75
Screenman	3.01–4.49
Bleacherman	3.12–4.84
Pulp tester	3.18–3.68
Paper and paperboard plants	
Stock preparation occupations:	
Head stock preparer (beater engineer)	$3.21–4.84
Beaterman	2.92–3.92
Machine room occupations:	
Paper machine tender	3.66–5.86
Backtender	3.28–5.30
Third hand	3.01–4.48
Fourth hand	2.80–4.48
Paper tester	3.10–4.11
Finishing occupations:	
Supercalendar operator	3.16–4.24
Rewinder operator	3.12–3.85
Rewinder helper	2.89–3.48
Cutters	3.01–3.86
Miscellaneous occupations:	
Pipefitter	3.22–4.74
Machinists	3.25–4.97
Electrician	3.53–4.87
Oiler	3.15–3.92
Janitor	2.75–3.43

Most workers in pulp and paper producing operations work in plants that operate around the clock—three shifts a day, 7 days a week. Owing to the widespread industry practice of rotating shifts, production workers can expect to work on evening or night shifts from time to time. Maintenance workers, for the most part, are employed on the regular day shift. Many plants pay between 7 and 11 cents more an hour for work on the evening shift and between 12 and 15 cents extra an hour for the night shift. Most workers have year-round employment because paper production is not subject to seasonal variations.

A work schedule of 40 hours a week is in effect in most mills. A few plants have a standard workweek of 36 hours or less.

Paid vacations are almost always provided and are generally based on length of service. In most mills, workers receive 1 week of vacation after 1 year of employment, 2 weeks after 3 to 5 years, and 3 weeks after 8 to 10 years. Many companies give 4 weeks vacation to employees who have been with them 20 years and 6 weeks after 30 years. Nearly all workers receive 6 to 11 paid holidays annually.

Insurance or pension plans, financed completely or partially by employers, are in effect in most plants. These plans generally include life, sickness, accident, hospitalization, and surgical insurance benefits for the employee and, in some cases, his dependents. Employee stock-purchase and savings plans, to which the company makes contributions, are also in effect in some firms.

Most pulp and papermaking jobs do not require strenuous physical effort. Some employees, however, work in hot, humid, and noisy areas. They also may be exposed to disagreeable odors from chemicals used in the papermaking process. Pulp and paper companies have made intensive efforts in recent years to improve working conditions.

The rate of disabling injuries in this industry has been about the same as the rate for all manufacturing in recent years. Protective clothing, warning signs in danger areas, locking devices on potentially dangerous equipment, guards and rails around moving machinery, and instruction in safe practices have been important in reducing the accident rate. Some of the more hazardous jobs are located in converting plants where many cutting tools and moving equipment are used.

A majority of production workers in this industry are members of trade unions. A large number belong to the International Brotherhood of Pulp, Sulphite and Paper Mill Workers; the United Papermakers and Paperworkers; or the Association of Western Pulp and Paper Workers. Many printing workers belong to the International Printing Pressmen and Assistants' Union of North America. Some maintenance workers and other craftsmen belong to various craft unions.

Sources of Additional Information

Further information about job opportunities and working conditions in this industry is available from local offices of the State employment service and from:

American Forest Institute, 1835 K St. NW., Washington, D.C. 20006.

American Paper Institute, 260 Madison Ave., New York, N.Y. 10016.

Fibre Box Association, 224 South Michigan Ave., Chicago, Ill. 60604.

National Paper Box Manufacturers Association, Inc., 121 North Broad St., Philadelphia, Pa. 19107.

Paper Industry Management Association, 2570 Devon Ave., Des Plaines, Ill. 60018.

PETROLEUM REFINING

The petroleum and natural gas industries provide about 75 percent of all the energy fuels consumed in this country. Products refined from crude oil supply the fuels and lubricants used for nearly all motor vehicles, locomotives, aircraft, and ships. Oil and gas provide much of the heat for homes, factories, and commercial establishments, as well as the fuel for over one-quarter of the electric power generated in this country. In addition, basic petroleum compounds are essential in the manufacture of hundreds of products in everyday use, such as synthetic rubber, and plastics.

In 1970 about 153.4 thousand workers, who have a wide range of educational backgrounds and skills, were employed in the various activities that make up the petroleum refining industry. This chapter deals with the jobs and activities involved in refining oil. The *Handbook* discusses in a separate chapter occupations concerned with petroleum and natural gas production and processing.

Nature and Location of the Industry

Petroleum refining converts crude oil into gasoline, jet fuel, kerosene, fuel oil, lubricants, asphalt, and other products for use in homes and industry. The modern refinery is a complicated facility made up of tanks and towers connected by a maze of pipes. From the time crude oil enters the refinery to the shipment of finished products, the flow of production is almost continuous. The refining process is highly instrumented. Operators use the instruments to measure and regulate the flow, volume, temperature, and pressure of liquids and gases going through the equipment. Manual handling of materials is virtually eliminated in the modern refinery.

Briefly, the first step in petroleum refining consists of heating crude oil as it flows through a series of pipes in a furnace. The vapors from the heated oil pass into a tower where the various "fractions," or parts, of crude oil are condensed. The heaviest parts (for example, asphalt) are drawn off along the bottom of the tower where temperatures are highest; lighter parts, jet fuel and automotive diesel fuel are drawn off along the middle of the tower; and the lightest and most volatile (gasoline and gases) are taken off at the top where temperatures are lowest. Further processing by more complicated methods combines or modifies compounds obtained through fractionating.

About 280 refineries were in operation in this country in 1970. They ranged in size from small plants which employed fewer than 50 employees to those which employed several thousand. Although most States have refineries, approximately 9 out of every 10 barrels of crude oil were refined in only 10

Operator regulates processing of crude oils from central controls.

States: Texas, California, Louisiana, Illinois, Indiana, Oklahoma, Ohio, Kansas, Pennsylvania, and New Jersey. Refineries usually are located near oil fields, consuming centers, or deepwater ports where tankers can dock.

Occupations in the Industry

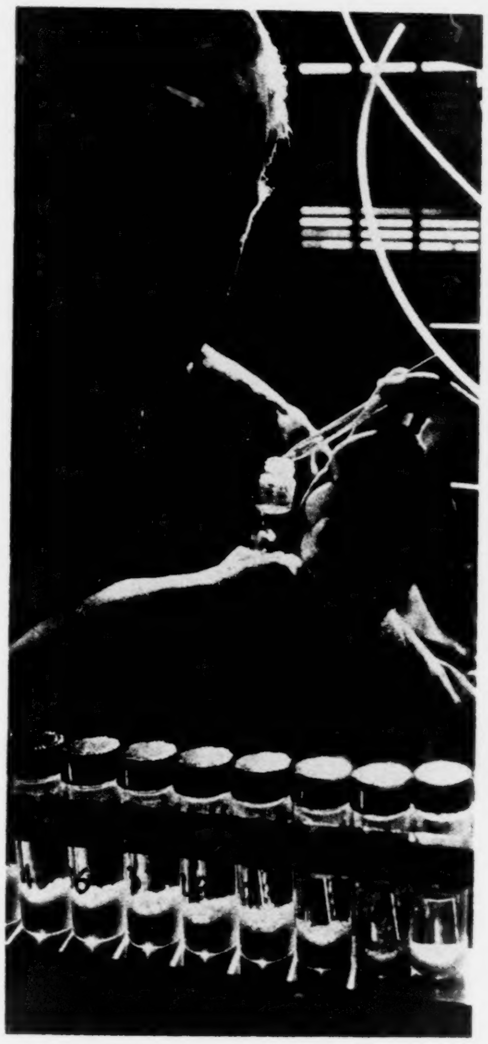
About 1 out of every 4 workers in refineries are operators. A key worker in converting crude oil into usable products is the *stillman* (D.O.T. 542.280), or chief operator. The stillman is also known by such job titles as coker operator and cracking operator. He is responsible for the efficient operation of one processing unit or more. The operator monitors instrument readings for any changes in temperature, pressure, and oil flow. In the modern refineries, the operator can watch instruments on graphic panels which show the entire operation of all processing units in the refinery. He regulates the instruments so that oil products will meet specifications. From time to time, the operator patrols all units for which he is responsible to check their operating condition and to take samples for testing. The number and size of the units determine whether he has more than one assistant (D.O.T. 542.782).

Other plant workers whose jobs are related to the processing of crude oil include *pumpmen or pumpers* (D.O.T. 549.782) and their *helpers* (D.O.T. 549.884), who maintain and operate power-driven pumps which circulate petroleum products, chemicals, and water through units during processing; and *treaters* (D.O.T. 549.782), who operate equipment to remove impurities from gasoline, oil, and other petroleum products.

In many refineries, a large percentage of the plant workers repair, rebuild, and clean the highly complicated refinery equipment. In other plants, maintenance work is contracted to companies outside the petroleum industry. A large number of maintenance workers are needed because of the complex equipment and the fact that high heat and pressure and corrosion quickly wear out equipment. Included among these are skilled boilermakers, carpenters, electricians, instrument repairmen, lead burners, machinists, masons, painters, pipefitters, insulators, riggers, sheetmetal workers, and welders. Many helpers and trainees are also in these trades. Some skilled workers have a primary skill in one craft as well as the ability to handle the duties of closely related crafts. For example, a pipefitter also may be able to do boilermaking and welding repair work on a piece of equipment. Maintenance workers who have such combined jobs are sometimes called *refinery mechanics*.

Plant workers who do not operate or maintain equipment do a variety of other tasks in refineries. Some workers are employed in the packaging and shipping department; some load and unload materials on trucks, trains, or ships; some drive trucks and tractors to deliver materials to various parts of the plant; and others keep inventory records of stock and tools. The industry also employs custodial workers such as guards and watchmen.

About 13 percent (slightly fewer than 20,000), of the workers in petroleum refining are scientists, engineers, and technicians, compared with almost 12 percent (slightly fewer than 32,000) in petroleum production. Among these professional and technical refinery workers are chemists, chemical engineers, mechanical engineers, petroleum engineers, systems engineers, waste treatment engineers, electrical engineers, metallurgical engineers, laboratory technicians, and draftsmen. Chemists and laboratory technicians control the quality of petroleum products by making tests and analyses to determine chemical and physical properties. Some chemists and chemical engineers are engaged in research and development activities to develop new products and processes and to improve those already produced. Laboratory technicians also assist chemists in research projects or do routine testing and sample taking. Some engineers design chemical processing equipment and plant layout and others supervise refining



processes. Waste treatment engineers and technicians are engaged in improving treatment and disposal of refinery waste waters and gases. Draftsmen prepare detailed plans and drawings needed in refinery construction and maintenance.

Many administrative, clerical, and other white-collar personnel are employed by refining companies. A large number of top administrative and management positions are filled by technically trained people, many of whom are chemists or engineers. Other specialized workers in the field of administration include accountants, purchasing agents, lawyers, and personnel and training specialists. Many typists, stenographers, secretaries, bookkeepers, and business machine operators are employed to assist these specialized workers. The increasing use of computers in petroleum refining requires workers trained as systems analysts, coders, programmers, and key punch operators. (Detailed discussions of professional, technical, mechanical, and other occupations found not only in the petroleum refining industry but also in other industries are given in the section of this *Handbook* covering the individual occupations. See index for page numbers.)

Training, Other Qualifications, and Advancement

Petroleum refineries typically require new plant workers to have a high school or vocational school education. In large refineries, aptitude and psychological testing and interviewing may be used in selecting employees. Usually, a new worker begins as an aid in a labor pool where he does such jobs as moving materials, packing cartons, or filling barrels. Depending on his particular aptitudes and seniority he may be transferred to the processing department or maintenance shop when a vacancy occurs.

A worker newly assigned to a processing department learns to operate processing equipment under the supervision of experienced workers. As he gains experience and know-how, he moves to the more skilled jobs in his department. For example, one line of advancement for a processing worker may be from helper to assistant operator to chief operator. Formal training courses frequently are provided to assure thorough and current knowledge in a variety of operations.

An inexperienced worker who is assigned to a maintenance shop receives training on the job under the supervision of the foreman. In some refineries, he also may receive classroom instruction related to his particular work. Over a period of 3 or 4 years, he may advance from helper to skilled craftsman in one of the maintenance jobs. Some large refineries have programs under which workers are given training in several related maintenance crafts. For example, a qualified instrument repairman may be given additional training as electrician or machinist.

For scientists and engineers a bachelor's degree in science or engineering usually is the minimum educational requirement. For research jobs, scientists and engineers with advanced degrees are preferred. For most laboratory assistant jobs, 2-year technical school certificates are required.

Laboratory assistants begin their work in routine jobs and advance to positions of greater responsibility as they acquire additional experience and demonstrate ability to work without close supervision. Inexperienced draftsmen begin as copyists or tracers. With additional experience and training, they may advance to more skilled and responsible drafting positions. Administrative positions generally are filled by men and women who have college degrees in business administration, marketing, accounting, industrial relations, or other specialized fields. For positions as clerks, bookkeepers, stenographers, and typists, most refineries employ persons who have had commercial courses in high school or business school. For occupations associated with computers, educational requirements range from a high school level for key punch operators to a college degree in the physical science field for analysts.

Employment Outlook

Through the 1970's several thousand job openings are expected each year in petroleum refineries to replace workers who die, retire, or transfer to other fields.

Total employment will change little despite continued expansion of refinery output for the expected increase in the consumption of petroleum products. Improved methods of refining crude oil and larger refineries with greater productive capacity will limit requirements for new workers.

Most jobs created by turnover in petroleum refining will be for professional, administrative, and technical workers, particularly chemical engineers, and technicians for research and development. Among plant workers most jobs will be in maintenance occupation and will include instruments repairmen, pipefitters, machinists, maintenance electricians, instrumentmen, and welders because of the increasing use of automated equipment and complex control instruments.

Earnings and Working Conditions

Refinery workers are among the highest paid employees in American industry. In 1970 production workers in petroleum refining averaged $189.93 a week, or $4.49 an hour for a 42.3 hour workweek. This salary compares with an average for all manufacturing industries of $133.73 a week, or $3.36 an hour. The higher average earnings of production workers in refineries reflect the relatively large proportion of workers in skilled occupations.

Entry salaries for chemical engineers in the petroleum refining industry were among the highest in American industry, according to a survey conducted by the American Chemical Society in 1970. The survey showed that in this industry the average starting salary for chemists who have a bachelor's degree and no experience was $800 a month and for chemical engineers, $925 a month.

Most petroleum refinery workers receive a 2-week vacation with pay after 1 year of service; 3 weeks, after 5 years; 4 weeks, after 10 years; and 5 weeks after 20 years. Most refineries have adopted life insurance, pension, and medical and surgical plans for their employees. Employee stock-purchase and savings plans, to which the employer makes contributions, are in effect in many firms.

Because petroleum refining is a continuous round-the-clock operation, operators may be assigned to one of the three shifts, or they may be rotated on various shifts and be subject to Sunday and holiday work. Employees usually receive 15 to 30 cents an hour additional pay when they work on the second or third shift. Most maintenance workers are on duty during the day shift; only a few work at night to handle emergencies. Work in the industry has little seasonal variation and regular workers have year-round jobs.

Most refinery jobs require only moderate physical effort. A few workers, however, have to open and close heavy valves and climb stairs and ladders to considerable heights in the course of their duties. Others may work in hot places or may be exposed to unpleasant odors. Refineries are relatively safe places in which to work. The injury-frequency rate is about half that of manufacturing as a whole.

A majority of refinery plant workers are union members. A large number of refineries have been organized by the Oil, Chemical and Atomic Workers International Union. Some refinery workers are members of AFL-CIO craft unions or of various independent unions.

See the petroleum and natural gas production and processing chapter for Sources of Additional Information.

TRANSPORTATION, COMMUNICATIONS, AND PUBLIC UTILITIES

The transportation, communications, and public utilities industries make possible the smooth functioning of our society and produce most of the energy that powers, heats, and lights our factories and homes. The transportation industry moves goods and people by air, rail, water and highway; the communications industry provides communications systems such as telephones and radio and TV broadcasting. Other public utilities supply the Nation with electricity and gas, and with sanitation services. Transportation, communications, and public utility firms are all semipublic in character. Some State and local governments operate their own transit lines or electric companies as well as other types of utilities. Privately owned transportation and public utility firms are regulated closely by commissions or by other public authorities to make sure they operate in the public interest.

In 1970, 4.5 million persons were employed in the transportation, communications, and public utilities industry group. In addition, more than one-half million persons were employed by State and local governments in publicly owned transit and utility systems. Almost half of the workers in this major industry group were employed in two industries: the communications industry with 1.1 million workers (including telephone, telegraph, and radio and TV broadcasting); and the motor freight industry with 1.0 million workers (including local and long-distance trucking). Electric, gas, and sanitary services companies employed about 685,000 workers and railroads about 625,000. Other industries with significant employment included air transportation and local and interurban passenger transit. The remaining workers were employed by firms that provided water and pipeline transportation and transportation services.

About one-fifth of the persons employed in transportation, communications, and public utilities were women, a ratio substantially lower than for the economy as a whole. Employment of women varies greatly among the individual industries. For example, they represented only 7 percent of employment in water transportation; however, in communications, where many work as telephone operators, women accounted for one-half of employment.

Blue-collar workers made up more than half of employment in the transportation, communications, and public utilities industry group in 1970. Operatives alone accounted for 27 percent of employment. Most of these semiskilled workers were truck, bus, and taxi drivers, and railroad brakemen and switchmen. Craftsmen, foremen, and kindred workers made up another 21 percent of employment. Among the major occupations in this group are airplane mechanic, motor vehicle mechanic, telephone lineman, locomotive engineer, and stationary engineer. Another eight percent of the employees were laborers, such as material handlers and truckdrivers' helpers.

About two-fifths of the industry group's employees were white-collar workers, mostly in clerical occupations such as telephone operator, ticket agent, secretary, and bookkeeper. Nine percent of all employees were managerial workers, and 7 percent were professional and technical workers. Many of the latter groups were in the communications industry, where, in addition to large numbers of engineers and technicians, many actors, entertainers, and writers were employed.

Major occupational group	*Estimated employment, 1970 (percent distribution)*
All occupational groups	100
Professional, technical, and kindred workers	7
Managers, officials, and proprietors	9
Clerical and kindred workers	25
Sales workers	1
Craftsmen, foremen, and kindred workers	21
Operatives and kindred workers	27
Service workers	3
Laborers	8

NOTE—Due to rounding, sum of individual items may not add to total.

Employment in the transportation, communications, and public utilities industry group is expected to increase slowly through the 1970's. In addition, many thousands of job openings are expected each year because of the need to replace workers who die or retire. Transfer of employees to other industries will provide still additional job opportunities. Replacement needs will be particularly high in clerical positions because many women leave work each year to take on family responsibilities.

Employment growth in individual industries will vary significantly. Increasing popularity of air transportation for both passengers and cargo will spur continued rapid employment growth in this area. Rising population, business expansion, and growth of suburbs will stimulate employment in trucking. On the other hand, little employment change is expected in local and interurban passenger transportation (buses, taxis, and subways) because consumers probably will continue to rely heavily on private automobiles. The longrun decline in railroad employment is expected to continue, but at a decreasing rate.

Employment in communications is expected to grow slowly through the 1970's. Although demand for the industry's services will increase rapidly, advances in technology are expected to limit employment growth, particularly in telephone communications. The computer and other electronic equipment are expected to be applied increasingly to functions that have been performed by workers.

Employment in electric and gas utilities also will be affected strongly by advancing technology and employment will grow slowly despite rapid increases in output. Substantial improvements in electric generating equipment through the increasing use of nuclear power, electronic controls, and improved coal-handling techniques, as well as more efficient methods of constructing and maintaining transmission lines will limit employment growth in this industry.

The statements that follow cover major occupations in the transportation, communications, and public utility fields. More detailed information about occupations that cut across many industries—for example, secretaries and drivers—appear elsewhere in the *Handbook*. (See index in the back of the book.)

CIVIL AVIATION OCCUPATIONS

The rapid development of air transportation in the past two decades has increased the mobility of the population and has created many thousands of job opportunities in the civil aviation industry. By 1970 about 500,000 persons were employed in a variety of interesting and responsible occupations in this field.

Nature and Location of Civil Aviation Activities

Many different types of organizations provide civil aviation services for a variety of purposes. Scheduled airlines transport passengers, cargo, and mail. Other airlines, called supplemental, provide charter and nonscheduled flight service for passengers and cargo. A wide range of other civil aviation activities are conducted in general aviation, including company-owned aircraft to transport business employees or cargo (business flying); application of insecticides, fertilizers, and seed on land, crops, or forest (aerial application); small aircraft charter service on scheduled routes to small airports to deliver mail and light cargo (air-taxi operation); and inspection of pipelines and powerlines for breaks (industrial flying). In addition, general aviation includes maintenance and repair by government-licensed repair stations for general aviation aircraft (certified repair stations).

Civil aviation activities also include the regulatory and accident investigation functions of the Federal Aviation Administration (FAA), the Civil Aeronautics Board (CAB), and the National Transportation Safety Board (NTSB)—all part of the Federal Government. The FAA develops air safety regulations, inspects and tests aircraft and airline facilities, provides ground electronic guidance equipment, and gives tests for licenses to personnel such as pilots, flight engineers, dispatchers, and aircraft mechanics. The CAB establishes policy concerning matters such as airline rates and routes. The NTSB investigates all airlines accidents and general aviation aircraft accidents involving fatalities.

In 1970, the scheduled airlines employed 300,000 workers. Of these about 80 percent (240,000) were employed to fly and service aircraft and passengers on domestic routes—between cities in the United States. Nearly 50,000 other workers handled the operations of the scheduled airlines that fly international routes. The remaining workers handled only cargo.

In addition to scheduled airline employees, several thousand workers—all in ground occupations—were employed in the United States by foreign airlines that operate between overseas points and the United States.

An additional 5,285 workers were employed by 13 supplemental airlines in many of the same occupations as scheduled airline workers.

An estimated 18,000 pilots and 52,000 mechanics were employed full time in general aviation operations in 1970. In addition to full-time workers, thousands of pilots and a small number of mechanics were employed part time.

The FAA employed about 52,000 people and the CAB about 670 in 1970. The largest group of FAA employees worked mainly in occupations relating to the direction of air traffic and the installation and maintenance of mechanical and electronic equipment used to control traffic. CAB workers were employed mainly as administrators and clerks concerned with the economic regulation of the airlines, supervision of international air transportation, promotion of air safety, and investigation of accidents.

Civil aviation workers are employed in every State, but an estimated half work in five States; New York, California, Florida, Illinois, and Texas.

Civil Aviation Occupations

In addition to employing the largest number of air transportation workers, scheduled airlines employ workers in a variety of occupations. By 1970, about 4 out of 5 were in ground occupations. Mechanical and other aircraft maintenance personnel was the largest category, followed by traffic agents and clerks. Other workers included cargo and freight handlers, custodial and other aircraft servicing personnel, and office, administrative, and professional personnel.

Flight occupations constituted the other one-fifth of airline employment. These occupations include stewardesses and stewards, the largest flight occupation, as well as pilots, copilots, and flight engineers.

Most of the general aviation workers were mechanics and pilots. Clerks and administrators made up nearly all of the remainder.

In the Federal Government, the largest group of 23,800 civil aviation workers were in air traffic servicing work. Of these, about 19,600 were air traffic controllers and 4,200 were flight service station specialists.

A detailed description of the duties, training, qualifications, employment outlook, earnings, and working conditions for each of the following air transportation jobs appear in the later sections of this chapter: (1) Pilots and copilots, (2) flight engineers, (3) stewardesses, (4) aircraft mechanics, (5) airline dispatchers, (6) air traffic controllers, (7) ground radio operators and teletypists, and (8) traffic agents and clerks.

The total number of workers in civil aviation occupations is expected to increase very rapidly during the 1970's, but the rates of growth among the major civil aviation divisions will differ.

General aviation employment is expected to show a rapid rise, mainly because the anticipated greater demand for general aviation services will lead to an increase in the number of aircraft. About 225,000 general aviation aircraft may be flying by 1980—an increase of about 90,000 over the number in 1970. A significant employment increase will occur in business flying; most new job openings will be for pilots. Employment growth also will be rapid in air-taxi operations, largely because of the demand for air transportation in cities not serviced by the scheduled airlines. These jobs will be about equally divided between qualified pilots and copilots and aircraft mechanics. An estimated 23,000 job openings—practically all for aircraft mechanics—will occur in certificated repair stations because of the need for additional maintenance and repair services by a larger general aviation fleet.

The number of operators who give flight instruction and engage in patrol and survey flying will grow very rapidly by 1980, and require thousands of additional pilots.

Use of aircraft for aerial application, which includes the distribution of chemicals or seeds in agriculture, fire fighting, and the restocking of fish and other wild life, will require a few thousand additional employees, mainly pilots.

A slow increase is expected in the employment of civil aviation workers by the Federal Government. Openings that occur will be primarily those resulting from retirements, deaths, and transfers to other fields of work. Although employment declines may occur in some occupations, increasing employment opportunities are expected for those who maintain and repair the increasing array of visual and electronic aids to air traffic.

Airline employment growth will result from anticipated increases in passenger and cargo traffic. By 1980, the scheduled airlines will fly about two times the number of revenue passenger miles flown in 1970. An even larger increase is expected in air cargo traffic which, however, represents a relatively small percent of total traffic. Among the factors which will contribute to increased air travel are a larger population, increased consumer purchasing power, the trend toward longer vacations, the greater use of air travel by businessmen, faster flights on jet aircraft which will save considerable time in long-distance travel, and more economy-class passenger services.

As in the past, airline occupations will grow at different rates. Occupations, such as stewardess and cargo and baggage handler, which provide services for passengers and cargo directly, will grow very rapidly. However, employment in these occupations is not expected to increase as fast as the increases in air traffic for several reasons, for example, more widespread installation of mechanical equipment, such as conveyors, will permit airlines to move greatly increased amounts of baggage and cargo without comparable growth in employment of baggage and cargo handlers. Economy flights, which offer fewer inflight services than first-class flights, will permit airlines to fly greatly increased numbers of passengers without a corresponding rise in employment of flight attendants.

The rapid growth in some airline occupations, particularly those concerned with the operation and maintenance of aircraft, will result from a substantial increase in the number of aircraft in service. Continuing replacement of present equipment by faster, larger capacity jet planes will accomodate part of the increased traffic, but a significant increase in the total number of aircraft in service also will be necessary. In addition to the growth of the industry in creating jobs, replacement needs will remain high throughout the 1970's because of retirements and deaths.

Earnings and Working Conditions

Earnings among various civil aviation occupations vary greatly because of factors such as skill requirements, length of experience, and amount of responsibility for safe and efficient operations. Within particular occupations, earnings vary according to the type of civil aviation activity. The statements on individual occupations which follow contain detailed discussions of earnings.

As a rule, airline employees and their immediate families are entitled to a limited amount of free or reduced-fare transportation on their companies' flights, depending on the employees' length of service. In addition, they may fly at greatly reduced rates with other airlines.

Flight personnel may be away from their home bases about one-third of the time or more. When they are away from home, the airlines provide either living accommodations or pay expenses.

Airlines operate flights at all hours of the day and night. Personnel in some occupations, therefore, often have irregular work schedules. Maximum hours of work per month for workers in flight occupations have been established by the FAA as a safety precaution against fatigue. In addition, union-management agreements often stipulate payment for a minimum number of hours each month.

Ground personnel who work as dispatchers, mechanics, traffic agents, communications operators, and administrators usually work a 5-day, 40-hour week. Their working hours, however, often include nights, weekends, or holidays. Air traffic controllers work a 5-day, 40-hour week; they are periodically assigned to night, weekend, and holiday work. Ground personnel generally receive extra pay for overtime work or compensatory time off.

In domestic operations, airline employees usually receive 2 to 4 weeks' vacation with pay, depending upon length of service. Most flight personnel in international operations get a month's vacation. Employees also receive paid sick leave, retirement benefits, life insurance, and long-term disability hospitalization benefits. FAA and CAB employees are entitled to the same benefits as other Federal personnel, including from 13 to 26 days of annual leave and 13 days of sick leave a year, as well as retirement, life insurance, and health benefits.

Many of the workers in air transportation are members of labor unions. The unions are identified in the statements covering the individual occupations.

Sources of Additional Information

Information about job openings in a particular airline, and the qualifications required may be obtained by writing to the personnel manager of the company. Addresses of individual companies are available from the Air Transport Association of America, 1000 Connecticut Ave. NW., Washington, D.C. 20036.

Inquiries regarding jobs with the Federal Aviation Administration should be addressed to the Personnel Officer, Federal Aviation Administration, at any of the following addresses:

Eastern Region.	Federal Building, John F. Kennedy International Airport, Jamaica, Long Island, N.Y. 11430.
Southwest Region.	P.O. Box 1689, Fort Worth, Tex. 76101.
Southern Region.	P.O. Box 20636, Atlanta, Ga. 30320.
Central Region.	601 E. 12th St., Kansas City, Mo. 64106.
Western Region.	5641 West Manchester Ave., Box 90007, Airport Station, Los Angeles, Calif. 90009.
Alaskan Region.	632 Sixth Ave., Anchorage, Alaska 99501.
Pacific Region.	P.O. Box 4009, Honolulu, Hawaii 96812.

Information concerning FAA-approved schools offering training for work as an aircraft mechanic, pilot, or in other technical fields related to aviation may be obtained from the Information Retrieval Branch, Federal Aviation Administration Library, HQ-630, Federal Aviation Administration, Washington, D.C. 20553.

PILOTS AND COPILOTS

(D.O.T. 196.168, .228, .268, and .283)

Nature of the Work

The men who have the responsibility for flying a multimillion dollar plane and safely transporting passengers are the pilot and copilot. The pilot (called "captain" by the airlines) operates the controls and performs other tasks necessary for flying a plane, keeping it on course, and landing it safely. He supervises the copilot, flight engineer, and flight attendants. The copilot is second in command. He assists the captain in air-to-ground communications, monitoring flight and engine instruments, and in operating the controls of the plane.

Both captain and copilot must do a great deal of planning before their plane may take off. They confer with the company meteorologist about weather conditions and, in cooperation with the airline dispatcher, they prepare a flight plan along a route and at altitudes which offer the best weather and wind conditions so that a safe, fast, and smooth flight may be possible. This flight plan must be approved by Federal Aviation Administration (FAA) air traffic control personnel. The copilot plots the course to be flown and computes the flying time between various points. Before takeoff, both men check the operation of each engine and the functioning of the plane's many instruments, controls, and electronic and mechanical systems.

During the flight, the captain or copilot reports by radio to ground control stations regarding their altitude, air speed, weather conditions, and other flight details. The captain also supervises the navigation of the

flight and keeps close watch on the many instruments which indicate the plane's fuel load and the condition of the engines, controls, electronic equipment, and landing gear. The copilot assists in these duties.

Before landing, the captain or the copilot recheck the operation of the landing gear and request landing clearance from air traffic control personnel. If visibility is limited when a landing approach is being made, the captain may have to rely primarily on instruments such as the altimeter, air speed indicator, artificial horizon, and gyro compass and instrument landing system. Both men must complete a flight report and file trip records in the airline office when the flight is ended.

Some pilots, employed by airlines as "check pilots," make at least two flights a year with each captain to observe his proficiency and adherence to FAA flight regulations and company policies. Airlines employ some pilots to fly planes leased to private corporations. Airlines also employ pilots as instructors to train both new and experienced pilots in the use of new equipment.

Although pilots employed in general aviation usually fly planes smaller than those used by the scheduled airlines, their preflight and flight duties are similar to those of airline pilots. These pilots seldom have the assistance of flight crews. In addition to flying, they may perform minor maintenance and repair work on their planes. In some cases, such as in business flying, they may mingle with and act as host to their passengers. Pilots who are self-employed, such as airtaxi operators, in addition to flying and doing some maintenance work, have duties similar to those of other small businessmen.

Places of Employment

The scheduled airlines employed over 27,000 pilots and copilots in 1970. In addition, approximately 1,600 pilots were employed by the certificated supplemental airlines (airlines that provide charter and nonscheduled service).

An estimated 18,000 pilots and copilots were employed full-time in general aviation in 1970. Several thousand worked in business flying and air-taxi operations. About 1,600 pilots were employed in aerial application flying. The Federal Government employed approximately 2,500 pilots (about one-fifth in the FAA) to perform a variety of services such as examining applicants for pilots' licenses, inspecting navigation facilities along Federal airways, testing planes that are newly designed or have major modifications, enforcing game laws, fighting forest fires, and patrolling national boundaries. In addition, State and local governments employed about 800 pilots. Several thousand pilots were employed by companies to inspect pipelines and installations for oil companies, and to provide other aerial services such as private flight instruction, and flights for sightseeing and aerial photography. A small number worked for aircraft manufacturers as test pilots. In addition, thousands of pilots were employed on a part-time basis. These workers were distributed among all the various general aviation activities.

Training, Other Qualifications, and Advancement

To do any type of commercial flying, pilots or copilots must be licensed by the FAA. Airline captains must have an "airline transport pilot's" license. Copilots, and most pilots employed in general aviation, must have a "commercial airplane pilot's" license. In addition, pilots who are subject to FAA instrument flight regulations or who anticipate flying on instruments when the weather is bad, must have an "instrument rating." Pilots and copilots also must have a rating for the class of plane they can fly (single-engine, multi-engine, or seaplane), and for the specific type of plane they can fly, such as DC-9 or Boeing 747.

To qualify for a license as a commercial pilot, applicants must be at least 18 years old and have at least 200 hours of flight experience. To obtain an instrument rating, applicants must have at least 40 hours of instrument time, 20 hours of which must be in actual flight. Applicants for an airline transport pilot's license must be at least 23 years old and have a total of 1,500 hours of flight time during the previous 8 years, including night flying and instrument flying time.

Before a person may receive any license or rating, he must pass a physical examination and a written test given by the FAA covering subjects such as principles of safe flight operations, Federal Aviation Regulations, navigation principles, radio operation, and meterology. He also must submit proof that he has completed the minimum flighttime requirements and, in a practical test, demonstrate flying skill and technical competence. His certification as a professional pilot remains in effect as long as he can pass an annual physical examination and the periodic tests of his flying skills required by Government regulation. An airline transport pilot's license expires when the pilot reaches his 60th birthday.

A young man may obtain the knowledge, skills, and flight experience necessary to become a pilot through military service or from a private flying school. Graduation from flying schools approved by the FAA satisfies the flight experience requirements for licensing. Applicants who have appropriate military flight training and experience are required to pass only the Federal Aviation Regulations examination if they apply for a license within a year after leaving the service. Those trained in the armed services have the added opportunity to gain experience and accumulate flying time on large aircraft similar to those used by the airlines.

As a rule, applicants for a copilot job with the airlines must be between 20 and 35 years old, although preference is given to applicants who are between ages 21 and 28. They must be 5 feet 6 inches to 6 feet 4 inches tall and weigh between 140 and 210 pounds. All applicants must be high school graduates; some airlines require 2 years of college and prefer to hire college graduates. Physical requirements for pilots, especially in scheduled airline employment, are very high. They must have at least 20/100 vision corrected to 20/20, good hearing, outstanding physical stamina, and no physical handicaps that would prevent quick reactions. Since flying large aircraft places great responsibilities upon a pilot, the airlines use psychological tests to determine an applicant's alertness, emotional stability and maturity, and his ability to assume responsibility, command respect, and make quick decisions and accurate judgments under pressure.

Men hired by the scheduled airlines (and by some of the larger supplemental airlines) usually start as flight engineers, although they may begin as copilots. An applicant for a flight crew member job with a scheduled airline often must have more than the FAA minimum qualifications for commercial pilot licensing. For example, although the FAA requires only 200 flying hours to qualify for such a license, the airlines generally require from 500 to 1,000 flying hours. Airlines also require a "restricted" radio-telephone operator permit, issued by the Federal Communications Commission, which allows the holder to operate the plane's radio.

Pilots employed in business flying are required to have a commercial pilot's license. In addition, some employers require their pilots to have instrument ratings, and some require pilot applicants to have air transport pilot ratings. Because of the close relationship between pilots and their passengers, employers look for job applicants who have pleasant personalities.

All newly hired airline copilots go through company orientation courses. In addition, some airlines give beginning copilots or flight engineers from 3 to 10 weeks of training on company planes before assigning them to a scheduled flight. Trainees also receive classroom instruction in subjects such as flight theory, radio operation, meteorology, Federal Aviation Regulations, and airline operations.

The beginning copilot generally is permitted only limited responsibility, such as operating the flight controls in good weather over a route that is easy to navigate. As he gains experience and skill, his responsibilities are increased gradually, and he is promoted to copilot on larger, more modern aircraft. When he has proved his skill, accumulated sufficient experience and seniority; and passed the test for an airline transport pilot's license, a copilot may advance to captain as openings arise. A minimum of 2 or 3 years' service is required for promotion but, in actual practice, advancement often takes at least 5 to 10 years or longer. The new captain works first on his airline's smaller equipment and, as openings arise, he is advanced to larger, more modern aircraft.

A few opportunities exist for captains who have administrative ability to advance to chief pilot, flight operations manager, and other supervisory and executive jobs. Most airline captains, however, spend their entire careers flying. As they increase their seniority, they obtain a better selection of flight routes, types of aircraft, and schedules which offer higher earnings. Some pilots may go into business for themselves if they have adequate financial resources and business ability. They may operate their own flying schools or air-taxi and other aerial services. Pilots also may shift to administrative and inspection jobs in aircraft manufacturing and Government aviation agencies, or become dispatchers for an airline when they are no longer able to fly.

Employment Outlook

A rapid rise in the employment of airline pilots is expected through the 1970's. In addition to those needed to staff new positions, several thousand job openings will result from the need to replace pilots who transfer to other fields of work, retire, or die. Although larger, faster, and more efficient jet planes are likely to be used in the years ahead, increased passenger and cargo miles may exceed substantially the increase in capacity realized from the new equipment. Therefore, employment of pilots is likely to increase to the extent that increased growth of traffic exceeds increased capacity.

Employment of pilots in general aviation activities is expected to continue to grow very rapidly, particularly in business flying, aerial application, air-taxi operations, and patrol and survey flying. Growth in these areas will result from the greater use of aircraft to perform these general aviation activities.

Earnings and Working Conditions

Captains and copilots are among the highest paid wage earners in the Nation. Those employed by the scheduled airlines averaged about $30,000 a year in domestic air transportation and nearly $37,000 in international operations in 1970. Most of the senior captains on large aircraft earned well over 35,000 a year; those assigned to large jet aircraft may earn as much as $48,000. Pilots employed by the scheduled airlines generally earn more than those employed elsewhere, although pilots who work for supplemental airlines may earn almost as much. Some experienced copilots were earning as much as $27,000 a year in domestic flying and more than $30,000 in international flying in 1970.

The earnings of captains and copilots depend on factors such as the type, size, and speed of the planes they fly, the number of hours and miles flown, and their length of service. They receive additional pay for night and international flights. Captains and airline copilots who have at least 3 years of service are guaranteed minimum monthly earnings which represent a substantial proportion of their earnings.

Under the Federal Aviation Act, airline pilots cannot fly more than 85 hours a month; some union-management contracts, however, provide for 75-hour a month maximums. Though pilots and copilots, in practice, fly approximately 60 hours a month, their total duty hours, including before- and after-flight activities and layovers before return flights, usually exceed 100 hours each month.

Some pilots prefer shorter distance flying usually associated with local airlines and commercial flying activities, such as air-taxi operations, because they are likely to spend less time away from their home bases and fly mostly during the daytime. These pilots, however, have the added strain of making more takeoffs and landings daily.

Although flying does not involve much physical effort, the pilot often is subject to stress because of his great responsibility. He must be constantly alert and prepared to make decisions quickly. Poor weather conditions also can make his work more difficult.

Most airline pilots are members of the Airline Pilots Association, International. The pilots employed by one major carrier are members of the Allied Pilots Association.

Sources of Additional Information

Air Line Pilots Association, International, 1329 E St., NW., Washington, D.C. 20004.

(See the introductory section for additional sources of information and for general information on supplementary benefits and working conditions.)

FLIGHT ENGINEERS

(D.O.T. 621.281)

Nature of the Work and Places of Employment

The flight engineer monitors the operation of the different mechanical and electrical devices aboard the airplane. Before takeoffs, he may inspect the tires and other outside parts of the plane and make sure that the plane's fuel tanks have been filled properly. Inside the plane, he assists the pilot and copilot in making preflight checks of instruments and equipment. Once the plane is airborne, the flight engineer watches and operates many instruments and devices to check the performance of the engines and the air-conditioning, pressurizing, and electrical systems. In addition, he keeps records of engine performance and fuel consumption. He reports any mechanical difficulties to the pilot and, if possible, makes emergency repairs. Upon landing, he makes certain that mechanical troubles that may have developed are repaired by a mechanic. Flight engineers employed by smaller airlines may have to make minor repairs at those few airports where mechanics are not stationed.

Flight engineers or second officers are required by the Federal Aviation Administration (FAA), to be on almost all three- and four-engine aircraft and some two-engine jet aircraft. An evaluation of the aircraft and the functions to be performed by the crew determines the need for a flight engineer. In 1970 about 8,500 workers were employed to perform flight engineers' duties, mostly by major airlines.

Training, Other Qualifications, and Advancement

All flight engineers must be licensed by the FAA. A man can qualify for a flight engineer's certificate if he has had 2 years of training or 3 years of work experience in the maintenance, repair, and overhaul of aircraft and engines, including a minimum of 6 months' training or a year of experience on four-engine piston and jet planes. He also may qualify with at least 200 hours of flight time as a captain of a four-engine piston or jet plane, or 100 hours of experience as a flight engineer in the Armed Forces. The most common method of qualifying is to complete a course of ground and flight instruction approved by the FAA.

In addition to such experience or training, an applicant for a license must pass a written test on flight theory, engine and aircraft performance, fuel requirements, weather as it affects engine operation, and maintenance procedures. In a practical flight test on a four-engine plane, he must demonstrate his skill in performing preflight duties and normal and emergency in-flight duties and procedures. He also must pass a rigid physical examination every year. Most scheduled airlines now require applicants for flight engineer positions to have a commercial pilot's license.

Young men can acquire the knowledge and skills necessary to qualify as airline flight engineers through military training as aircraft pilots, mechanics, or flight engineers. They also may attend a civilian ground school and then gain experience as an airplane mechanic.

For flight engineers, airlines generally prefer men who are 21 to 35 years of age, from 5 feet 6 inches to 6 feet 4 inches tall, and in excellent physical condition. Good eyesight (including color-vision) and eye-hand co-ordination are essential. All the major carriers require a high school education but prefer at least 2 years of college. They prefer to hire young men who already have a flight engineer certificate and a commercial pilot's license, although they may train applicants who have only a commercial pilot's license. A young person considering a career as a flight engineer must be able to cope with the pressures and responsibilities that are part of the occupation, and he must be concerned with details. He also must be able to function as part of a team and quickly learn to operate new equipment.

Advancement opportunities usually depend on qualifications and seniority provisions established by airline union-management agreements. The flight engineer with pilot qualifications, generally called the second officer, advances on the basis of his seniority to copilot, and then follows the regular line of advancement open to other copilots. Flight engineers without pilot qualifications can advance from less desirable to more desirable routes and schedules as they gain seniority.

Employment Outlook

Employment of flight engineers is expected to increase very rapidly during the 1970's as the number of heavier jet-powered aircraft, requiring flight engineers, increases. This development will contribute to employment growth in this field, since, in most cases, the third required crew member will be a qualified pilot serving as a flight engineer until his promotion to copilot. (See also the *Handbook* statement for Pilots and Copilots.)

Earnings and Working Conditions

Flight engineers earned from $1,277 a month for new employees to approximately $2,465 for experienced flight engineers on jet aircraft on international flights. Many flight engineers earned between $1,590 and $2,020 a month. Average monthly earnings for all flight engineers in domestic operations was nearly $1,702. Those employed on international flights averaged nearly $1,920. The earnings of flight engineers depend upon size, speed, and type of plane; hours and miles flown; length of service; and the type of flight (such as night or international). Engineers are guaranteed minimum monthly earnings, which represent a substantial proportion of their total earnings. Their flight time is restricted, under the Federal Aviation Act, to 85 hours a month. Flight engineers in international operations are limited to 100 hours a month, 300 hours every 90 days, or 350 hours every 90 days, depending on the size of the flight crew.

Most flight engineers who are not qualified pilots belong to the Flight Engineers' International Association or the International Association of Machinists and Aerospace Workers. Those who are qualified pilots (Second Officers) are represented by the Air Line Pilots Association, International.

Sources of Additional Information

Flight Engineers' International Association, 100 Indiana Ave. NW.,
Washington, D.C. 20001.

(See the introductory section for additional sources of information and for general information on supplementary benefits and working conditions.)

STEWARDESSES

(D.O.T. 352.878)

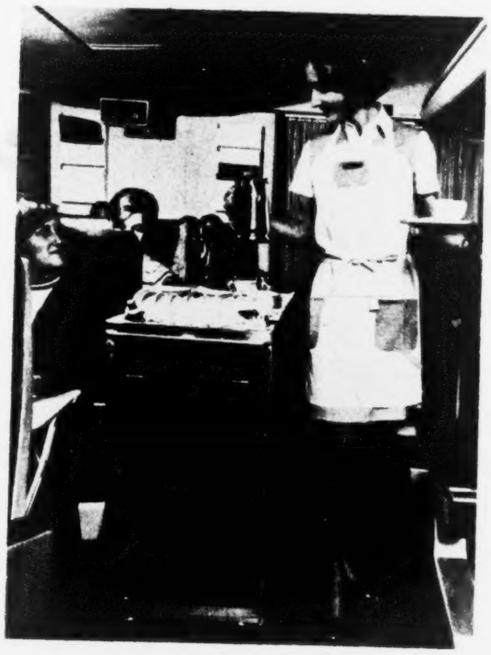
Nature of the Work and Places of Employment

Stewardesses or stewards (sometimes called flight attendants) are aboard almost all commercial passenger planes to make the passengers' flight safe, comfortable, and enjoyable. Like other flight personnel, they are responsible to the captain.

Before each flight, the stewardess attends the briefing of the flight crew. She sees that the passenger cabin is in order, that supplies and emergency passenger gear are aboard, and that necessary food and beverages are in the galley. As the passengers come aboard, she greets them, checks their tickets, and assists them with their coats and small luggage. On some flights, she may sell tickets.

During the flight, the stewardess checks seat belts and gives safety instructions. She answers questions about the flight and weather, distributes reading matter and pillows, helps care for small children and babies, and keeps the cabin neat. On some flights, she heats and serves meals that have been previously cooked. On other flights, she may prepare, sell, and serve cocktails, wine and other alcoholic beverages. After the flight, she completes flight reports. On international flights, she also gives customs information, instructs passengers on the use of emergency equipment, and repeats instructions in an appropriate foreign language to accommodate foreign passengers.

About 35,000 stewardesses and stewards worked for the scheduled airlines in 1970. About 80 percent were employed by the domestic airlines, and the rest worked for international lines. Nearly all stewards were employed on overseas flights. Airliners generally carry 1 to 6 flight attendants, depending on the size of the plane and what proportion of the flight is economy or first-class. Large aircraft like the Boeing 747 require as many as 16 stewardesses. Most flight attendants are stationed in major cities at the airlines' main bases. A few who serve on international flights are based in foreign countries.



Training, Other Qualifications, and Advancement

The airlines place great stress on hiring young women who are attractive, poised, tactful, and resourceful. As a rule, applicants must be 19 to 27 years old, from 5 feet 2 inches to 5 feet 9 inches tall, weight in proportion to height but not exceeding 140 pounds, and be in excellent health. They also must have a pleasant speaking voice and good vision. The major airlines require that stewardesses be unmarried when hired but permit girls to work as stewardesses after they marry.

Applicants for stewardesses' jobs must be high school graduates. Those having 2 years of college, nurses' training, or experience in dealing with the public are preferred. Stewardesses who work for international airlines generally must be able to speak an appropriate foreign language fluently.

Most large airlines give newly hired stewardesses about 5 weeks' training in their own schools. Girls may receive free transportation to the training centers and also may receive an allowance while in attendance. Training includes classes in flight regulations and duties, company operations and schedules, emergency procedures and first aid, and personal grooming. Additional courses in passport and customs regulations are given trainees for the international routes. Toward the end of their training, students go on practice flights and perform their duties under actual flight conditions.

A few airlines that do not operate their own schools may employ graduates who have paid for their own training at private stewardesses' schools. Girls interested in becoming stewardesses should check with the airline of their choice before entering a private school to be sure that they have the necessary qualifications for the airline, and that the school's training is acceptable.

Immediately upon completing their training, stewardesses report for work at one of their airline's main bases. They serve on probation for about 6 months, and usually work with an experienced stewardess on their first flights. Before they are assigned to a regular flight, they may work as reserve flight attendants, on extra flights or replace stewardesses who are sick or on vacation.

Stewardesses may advance to first stewardess or purser, supervising stewardess, stewardess instructor, or recruiting representative. Advancement opportunities often come quickly because stewardesses work only about 2 or 3 years, on the average, and then resign to get married.

Employment Outlook

Several thousand stewardesses will be needed each year to replace about 30 percent of those who will resign each year. Some resign after they marry, others leave for other jobs. Despite thousands of applications each year for this glamorous occupation, airlines have difficulty obtaining enough young women to meet their high standards of attractiveness, personality, and intelligence.

Earnings and Working Conditions

An examination of union-management contracts covering several large domestic and international airlines indicates that in 1970, beginning stewardesses earned approximately $523 to $645 a month for 80 hours of flying time. Stewardesses having 2 years' experience earned approximately $587 to $836 a month.

Stewardesses employed on domestic flights averaged $600 a month in late 1970; those working on international flights averaged about $800.

Since commercial airlines operate around the clock, 365 days a year, stewardesses usually work irregular hours. They may work at night, on holidays, and on weekends. They usually are limited to 80 hours of flight time a month. In addition, they devote up to 35 hours a month to ground duties. As a result of irregular hours and limitations on the amount of flying time, some stewardesses may have 15 days or more off each month. Of course, some time off may occur between flights while away from home.

Airlines generally use the seniority bidding system for assigning home bases, flight schedules, and routes. Stewardesses who have the longest service, therefore, get the more desirable flights.

The stewardess' occupation is exciting and glamorous, with opportunities to meet interesting passengers and see new places. However, the work can be strenuous and trying. A stewardess may be on her feet during a large part of the flight. She must remain pleasant and efficient during the entire flight, regardless of how tired she may be.

Most flight attendants are members of either the Air Line Stewards and Stewardesses Association of the Transport Workers Union of America or the Stewards and Stewardesses Division of the Air Line Pilots Association, International.

(See introductory section for general information on supplementary benefits and working conditions.)

AIRCRAFT MECHANICS

(D.O.T. 621.281)

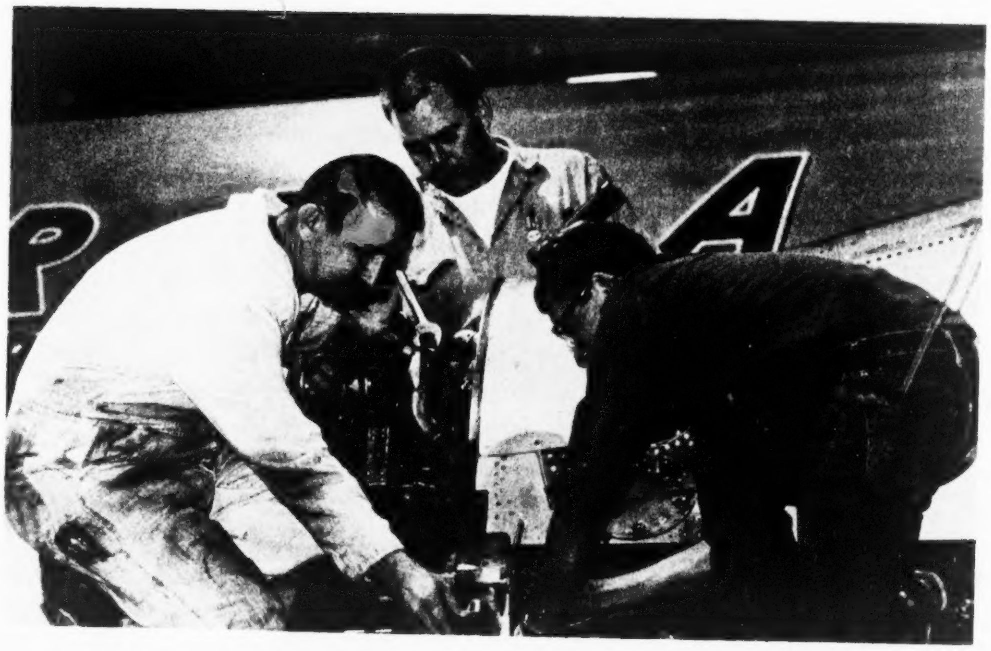
Nature of the Work

Aircraft mechanics keep planes operating efficiently. They make emergency repairs (line maintenance work) at the larger terminals or major repairs and periodic inspections at a particular part of the aircraft, such as propellers or landing gear, or work on sheet metal sections. Mechanics frequently dismantle a complex component to replace damaged or worn parts. After putting the plane together, they test it for perfect operation.

Line-maintenance mechanics must be all-round mechanics. The flight engineer or lead mechanic may instruct a line-maintenance mechanic or the mechanic may examine the aircraft to discover the cause of malfunction. He then makes the necessary adjustments or installs a new part. He may replace an entire engine which cannot be repaired.

Aircraft mechanics employed in general aviation usually do maintenance and repair work comparable with the work performed by line-maintenance mechanics. However, the planes which these mechanics service are generally smaller and less complex than those flown by the airlines. One mechanic frequently does the entire servicing job with little supervision, and he works on many different types of planes and engines. Mechanics who work for employers such as certificated supplemental airlines, air-taxi operators, and independent repair shops also may do overhaul work. Independent repair shops usually specialize in engine, instrument, or airframe overhaul. (The airframe consists of the plane's fuselage, wings, landing gear, flight controls, and other parts which are not part of the engine, propeller, or instruments.)

Aircraft mechanics use many different kinds of tools ranging from simple handtools, such as screwdrivers and wrenches, to expensive machines, such as magnetic and black light inspection equipment which detects flaws and cracks in metal parts.



Places of Employment

Over 54,000 mechanics were employed by the scheduled airlines in 1970. An estimated 52,000 mechanics and supervisors were employed by independent repair shops. A few thousand also were employed by certificated supplemental airlines, aerial application and air-taxi firms, and businesses that use their own planes to transport key employees or cargo. Many other mechanics work in aircraft manufacturing plants. (These workers, whose duties are somewhat different from those of airline mechanics, are discussed in the chapter on Occupations in the Aircraft, Missile, and Spacecraft Field.)

About 20,500 civilian aircraft mechanics were employed by the Air Force in 1970. Another 10,300 worked for the Navy. The FAA employs several hundred skilled men with maintenance experience to inspect aircraft manufacturing plants; examine airline and other commercial flying organizations' aircraft maintenance methods, training programs, and spare parts stock; and test applicants for FAA mechanic licenses. This agency also employs approximately 500 aircraft mechanics to maintain its own planes. Most of these men are employed at the FAA Aeronautical Center in Oklahoma City. Some mechanics are employed by other Government agencies, principally the National Aeronautics and Space Administration and the Army.

Most airline mechanics are employed in the larger cities on the main airline routes. Each airline usually has one main overhaul base where more than half of its mechanics are employed. Mechanics are concentrated in important domestic and international air traffic centers such as New York, Chicago, Los Angeles, San Francisco, and Miami.

Training, Other Qualifications, and Advancement

Mechanics responsible for any repair or maintenance operation must be licensed by the FAA as either an "airframe mechanic" (to work on the planes fuselage, covering surface, landing gear, and control surfaces such as rudder or ailerons); "powerplant mechanic" (to work on the plane's engines); "airframe and powerplant mechanic" (to work on all parts of the plane); or as a "repairman" who is authorized to make only specified repairs. Mechanics who maintain and repair electronic communications equipment are required to have at least a Federal Communications Commission Second Class Radio Telephone Operator License.

At least 18 months' experience working with airframes or engines is required to obtain an airframe or powerplant license, and at least 30 months' experience working with both engines and airframes is required for the combined airframe and powerplant license. However, this experience is not required of graduates of mechanic's schools approved by the FAA. In addition to these requirements, applicants must pass a written test and give a practical demonstration of their ability to do the work. Mechanics who maintain and repair their employers' planes have FAA authorization.

Mechanics may work as trainees or apprentices, or as helpers to experienced mechanics to prepare for their licenses. The larger airlines train apprentices or trainees in a carefully planned 3- or 4-year program of instruction and work experience. Men who have learned aircraft maintenance in the Armed Forces usually are given credit for this training towards the requirements of apprenticeship or other on-the-job training programs.

For trainee or apprentice jobs, airlines prefer high school or trade school graduates between 20 and 30 who are in good physical condition and who have had courses in mathematics, physics, chemistry, and machine shop. Experience in automotive repairs or other mechanical work also is helpful.

Aircraft mechanics must be able to do detailed work as part of a team. They should have manual dexterity, good eye-hand coordination, depth perception, and strength to lift heavy parts and tools. Agility is important for reaching and climbing that are part of the job. Aircraft mechanics must be willing to work in high places.

Other mechanics prepare for their trade by graduating from an FAA approved mechanics school. Most of these schools have an 18- to 24-month program. Several colleges and universities also offer 2-year programs that prepare the student for the FAA mechanic examinations, and for jobs as engineering aids and research and development technicians in aircraft manufacturing.

Mechanics generally are required to have their own handtools which they acquire gradually.

Several advancement possibilities are available to skilled mechanics employed by the scheduled airlines. The line of advancement is usually mechanic, lead mechanic (or crew chief), inspector, lead inspector, shop foreman, and, in a few cases, supervisory and executive positions. In most shops, mechanics in the higher grade positions are required to have both airframe and powerplant ratings. In many cases, the mechanic must pass a company examination before he is promoted.

To qualify for jobs as FAA inspectors, mechanics must have broad experience in maintenance and overhaul work, including supervision over the maintenance of aircraft. Applicants also must have both airframe and powerplant ratings or a combined rating.

Employment Outlook

The number of aircraft mechanics employed by scheduled airlines is expected to increase rapidly through the 1970's because of the substantial increase in the number of aircraft in operation. Rapid growth anticipated in general aviation flying will lead to an increase in the number of aircraft. An increase is expected in the number of mechanics employed both in firms providing general aviation services and in independent repair shops. Employment opportunities for aircraft mechanics in the Federal Government will depend largely on the size of the Government military aircraft program.

In addition to growth, a few thousand job openings will result annually from the need to replace mechanics who transfer to other fields of work, retire, or die.

Earnings and Working Conditions

Mechanics employed by the scheduled domestic and international airlines averaged between $800 and $1,100 a month in 1970. Other aircraft mechanics generally had lower average earnings. Airline mechanics work in hangars or in other indoor areas, whenever possible. However, when repairs must be made quickly, as in line-maintenance work, mechanics may work outdoors.

Aircraft mechanics sometimes must work in cramped places. Frequently they work under noisy conditions.

Mechanics employed by most major airlines are covered by union agreements. Most of these employees are members of the International Association of Machinists and Aerospace Workers. Many others belong to the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America and the Transport

Workers Union of America. (See introductory section for sources of additional information and for general information on supplementary benefits and working conditions.)

AIRLINE DISPATCHERS

(D.O.T. 912.168)

Nature of the Work and Places of Employment

Dispatchers (sometimes called flight superintendents) are employed by the airlines to coordinate flight schedules and operations within an assigned area; they also make sure that all Federal Aviation Administration (FAA) and company flight and safety regulations are observed. After examining weather conditions, the dispatcher makes a preliminary decision as to whether a flight may be undertaken safely. He frequently must arrange to notify the passengers and crew if there is any change from the scheduled departure time. The dispatcher confers with the captain about the quantity of fuel needed, the best route and altitude at which the plane will fly, the total flying time, and the alternate fields that may be used if landing at the scheduled airport is hazardous. The dispatcher and the captain must agree on all details of the flight before the plane leaves the airport. In some instances, the dispatcher is also responsible for keeping records and checking matters such as the availability of aircraft and equipment, the weight and balance of loaded cargo, the amount of time flown by each aircraft, and the number of hours flown by each crew member based at his station.

Airline dispatcher assists pilot in pre-flight planning.

After the flight has begun, the dispatcher plots the plane's progress as reported at regular intervals by the captain on the radio, and keeps the captain informed of changing weather and other conditions that might affect his flight.

The assistant dispatcher helps the dispatcher plot the progress of flights, secure weather information, and handle communications with aircraft.

In 1970 only about 1,200 dispatchers and assistants were employed in scheduled domestic and international operations, primarily at large airports in the United States. An even smaller number worked for large certificated supplemental airlines, and for private firms which offer dispatching services to small airlines.

Training, Other Qualifications, and Advancement

Dispatchers are required to have an FAA dispatcher certificate. To qualify, an applicant has to work at least a year under the supervision of a certified dispatcher or complete an FAA-approved dispatcher's course at a school or an airline training center. If an applicant has neither schooling nor experience, he also may qualify if he has spent 2 of the previous 3 years in air traffic control work, or in airline jobs such as dispatch clerk, assistant dispatcher, or radio operator, or in similar work in military service.

An applicant for an FAA dispatcher certificate must pass a written examination on subjects such as Federal aviation regulations, weather analysis, air-navigation facilities, radio procedures, and airport and airway traffic procedures. In an oral test, he also has to demonstrate his ability to interpret weather information, his knowledge of landing and cruising speeds and other aircraft operational characteristics, and his familiarity with airline routes and navigational facilities. A licensed dispatcher is checked periodically by his employer to make sure that he is maintaining the skills required by Federal regulations. All qualified dispatchers are given additional instruction by their airlines at special training centers so that they may become familiar with new flight procedures and with characteristics of new aircraft. Each year, he also is required to "fly the line" as an observer over the portion of the system which he services, to maintain his first hand familiarity with airline routes and flight operations.

An airline dispatcher must be able to make independent decisions. Oral skills are essential because dispatchers' instructions must be concise and easily understood.

For assistant dispatcher jobs, which may not require certification, airlines prefer men who have at least 2 years of college or who have worked an equivalent amount of time in some phase of air transportation, such as communications. Preference is given to college graduates who have had courses in mathematics, physics, and related subjects. Some experience in flying, meteorology, or business administration is also helpful.

Men who have worked in ground operations as dispatch clerks, meteorologists, or radio operators are preferred when assistant dispatcher positions are filled. A few jobs are filled by former pilots.

Employment Outlook

The number of workers in this very small occupation is not expected to change much during the 1970's. Most new workers will be hired as assistant dispatchers or dispatch clerks.

The need for some additional dispatchers will result from the increase in air traffic, the addition and extension of routes, and the extra difficulties in dispatching jet aircraft. However, these factors will be largely offset by improved radio and telephone communication facilities which allow dispatchers at major terminals to dispatch aircraft at other airports and over large geographic areas. Foreign-flag airlines, which fly between overseas points and cities in the United States, also will provide a few job opportunities for dispatchers.

Earnings and Working Conditions

Beginning dispatchers earned between $860 to $1,140 a month in 1970. Dispatchers having 10 years' service earned between $1,185 and $1,670 a month. Assistant dispatchers earned $572 and over a month to begin and up to $950 a month after 3 years. Assistant dispatchers who have FAA certificates may earn $25 a month extra. Most dispatchers are members of the Air-Line Dispatchers Association. Others are represented by the Transport Workers Union of America and the International Association of Machinists and Aerospace Workers.

Sources of Additional Information

Air Line Dispatchers Association,
929 West Broad St., Falls Church,
Va. 22130.

(See introductory section for additional sources of information and for general information on supplementary benefits and working conditions.)

AIR TRAFFIC CONTROLLERS

(D.O.T. 193.168)

Nature of the Work

Air traffic controllers are the guardians of the airways. These employees of the Federal Aviation Administration (FAA) give instructions, advice, and information to pilots by radio to avoid collisions and minimize delays as aircraft fly between airports or in the vicinity of airports. When directing aircraft, traffic controllers must consider many factors, including weather, geography, the amount of traffic, and the size, speed, and other operating characteristics of aircraft. The men who control traffic in the areas around airports are known as *airport traffic controllers;* those who guide aircraft between airports are called *air-route traffic controllers.*

Airport traffic controllers are stationed at airport control towers to give all pilots within the vicinity of the airport weather information and take-off and landing instructions such as which approach and airfield runway to use and when to change altitude. They must control simultaneously several aircraft which appear as tiny bars on a radar scope. Using numbers and remembering positions of planes in the air, they instruct each pilot by radio. These workers also keep records of all messages from aircraft and operate runway lights and other airfield electronic equipment. They also send and receive information from air-route traffic control centers about flights over the airport.

Air-route traffic controllers are stationed at air traffic control centers to coordinate the movements of aircraft which are being flown "on instruments." They use the written flight plans which are filed by pilots and dispatchers before aircraft leave the airport. To make sure that aircraft remain on course, they check the progress of flights, using radar and other electronic equipment and information received from the aircraft, other control centers and towers, and information from FAA or airline communications stations.

Where Employed

About 19,600 air traffic controllers were employed by the FAA in 1970. Of these, about half were airport traffic controllers, employed at airport control towers located at key airfields. A few of these jobs are lo-

cated at towers and centers outside the United States. About 10,900 air-route traffic controllers worked in 24 control centers scattered throughout the United States.

Training, Other Qualifications, and Advancement

Applicants for positions as air-route or airport traffic controller must be able to speak clearly and precisely. They enter the field through the competitive Federal Civil Service system after passing a rigid physical examination, which they must pass every year. Applicants must pass a written test designed to measure their ability to learn, perform the duties of air traffic controller, and meet certain experience, training, and related requirements.

Successful applicants for traffic controller jobs are given approximately 9 weeks of formal training to learn the fundamentals of the airway system, Federal Aviation Regulations, and radar and aircraft performance characteristics. After completing this training, controllers qualify for a basic air traffic control certificate. At an FAA control tower or center, they receive additional classroom instruction and on-the-job training to become familiar with specific traffic problems. Only after he has demonstrated his ability to apply procedures, and to use available equipment under pressure and stress, may he work as a controller. This usually takes about 2 to 3 years.

Controllers can advance to the job of chief controller. After this promotion, they may advance to more responsible management jobs in air traffic control and to a few top administrative jobs in the FAA.

Employment Outlook

Total employment of air traffic controllers is expected to increase moderately through the 1970's. The number of air traffic controllers is expected to increase despite the greater use of automated equipment.

Additional air traffic controllers will be needed because of the anticipated growth in the number of airport towers that will be built to reduce the burden on existing facilities and to handle increasing airline traffic. More airport controllers also will be needed to provide services to the growing number of pilots outside of the airlines, such as those employed by companies to fly executives.

A number of additional air-route traffic controllers will be needed during the next few years to handle increases in air traffic. However, with the expected introduction of an automatic air traffic control system and a further decline in the number of control centers, employment of air-route traffic controllers may moderate in the long run.

A few hundred openings will occur each year for controller jobs because of the need to replace those workers who leave for other work, retire, or die.

Earnings and Working Conditions

The monthly salary for air traffic controllers during their first 6 to 12 months of training averaged about $578 in 1970. Depending on the type of work, the amount of traffic at the facility, and length of time on the job, air traffic controllers can earn between $872 to $1,480 a month. In addition, traffic controllers are eligible for periodic wage increases. In areas that handle extremely large volumes of air traffic, a chief controller may earn more than $2,020 a month. These employees receive the same annual leave, sick leave, and other benefits provided other Federal workers.

FAA controllers work a basic 40-hour week; however, they may work overtime, for which they receive equivalent time off or additional pay. Because control towers and centers must be operated 24 hours a day, 7 days a week, controllers are periodically assigned to night shifts on a rotating basis. However, an additional 10 percent is paid for work between 6 p.m. and 6 a.m.

Because of the congestion in air traffic, a controller works under great stress. He must check simultaneously flights already under his control, know the flight schedules of air-craft approaching his area, and coordinate these patterns with other controllers as each flight passes from his control area to another.

(See introductory section for sources of additional information and for general information on supplementary benefits and working conditions.)

GROUND RADIO OPERATORS AND TELETYPISTS

(D.O.T. 193.282 and 203.588)

Nature of the Work

Ground radio operators and teletypists transmit highly important weather and flight information between ground station personnel and flight personnel. Radio operators use a radio-telephone to send and receive spoken messages. Radio operators occasionally may make minor repairs on their equipment. Teletypists transmit only written messages between ground personnel. They operate a teletype machine which has a keyboard similar to that of a typewriter.

Flight service station specialists employed by the Federal Aviation Administration (FAA) do some work similar to that of airline ground radio operators and teletypists. They use radio-telephones, radio-telegraph, and teletype machines in their work. In addition to providing pilots with weather and navigational information before and during flights, these workers relay messages from air traffic control facilities to other ground station personnel and to pilots.

Places of Employment

About 7,000 ground radio operators and teletypists were employed in air transportation in 1970. Flight service station specialists employed by the FAA made up about half of these employees. The scheduled airlines employed about 3,000 radio operators and teletypists. An additional 420 were employed by a cooperative organization which offers the airlines, private pilots, and corporation aircraft its services over a centralized communications system. A few hundred were employed by the Army and Navy in civilian communications occupations.

FAA flight service station specialists work at stations scattered along the major airline routes; some stations are located in remote places. Ground radio operators and teletypists employed by the airlines work mostly at airports in or near large cities.

Training, Other Qualifications, and Advancement

Applicants for airline radio operator jobs usually must have at least a third-class Federal Communications Commission radio-telephone or radio-telegraph operator's permit. However, a second-class operator's permit is preferred. They also must be high school graduates, have a good speaking voice, the ability to type at least 40 words a minute, and a basic knowledge of the language used in weather reports. Teletypists must be able to type at least 40 words a minute and have had training or experience in operating teletype equipment. Applicants for jobs as radio operators and teletypists also must have a knowledge of standard codes and symbols used in communications.

To qualify for entry positions as FAA flight service station specialists, applicants must pass a written test and meet certain experience requirements. Permanent appointments are made on the basis of Federal civil service examinations.

The airlines usually employ women as teletypists, and an increasing number are being hired as radio operators. Both airline radio operators and teletypists, and FAA flight service station specialists serve probationary periods during which time they receive on-the-job training. Skill gained in communications is helpful experience for transferring into such other higher paying jobs such as airline dispatcher.

Employment Outlook

Openings for entry positions as radio operators or teletypists will number fewer than a hundred each year during the 1970's. These openings will occur as workers transfer to other fields of work, retire, or die.

Overall employment of these workers may decline somewhat because of the use of more automatic communications equipment which permits communications for longer distances.

The number of flight service station specialists employed by the FAA is expected to increase slowly in the years ahead. Need for additional workers to perform more services for pilots will be offset by improvements in equipment, and an increase in two-way radios that permit communications between pilots and air traffic controllers. The number of radio operators and teletypists employed by airlines will increase slowly as communications systems becoming more automatic and centralized.

Earnings and Working Conditions

The beginning salary for airline radio operators who held the minimum third-class permit was between $628 and $788 a month in 1970. The beginning salary for teletypists was $505 a month and ranged up to $634 after 5 years. Beginning FAA flight service station specialists receive between $578 and $715 a month, depending on education and experience; experienced flight service specialists earn from $872 to $1,480 a month.

Radio operators and teletypists in a number of airlines are unionized. The major union in these occupational fields is the Communications Workers of America.

(See introductory section for sources of additional information and for general information on supplementary benefits and working conditions.)

TRAFFIC AGENTS AND CLERKS

(D.O.T. 912.368, 919.368)

Nature of the Work

Selling flight tickets, reserving seats and cargo space, and taking charge of the ground handling of planes are some of the duties of traffic agents and clerks. This group of workers includes ticket or reservation agents and clerks, operations or station agents, and traffic representatives.

Reservation sales agents and clerks give customers flight schedule and fare information over the telephone. Reservation control agents record reservations as they are made and report the reservations by teletype machine to a central computer or to clerks in other cities so that the same space will not be sold twice.

On some of the larger airlines, data processing systems receive, record, and transmit flight space information to personnel at airports and reservations officers throughout the entire airline system at great speeds. Ticket agents sell tickets and fill out ticket forms, including information such as the flight number and the passenger's name and destination. They also check and weigh baggage, answer inquiries about flight schedules and fares, and keep records of tickets sold. Traffic representatives contact potential customers to promote greater use of the airline services.

Operations or station agents are responsible for the ground handling of airplanes at their stations. They supervise the loading and unloading of the aircraft and sometimes do this work themselves. They see that the weight carried by the planes is distributed properly, compute gas loads and the weight carried by the plane, prepare a list of the cargo, and keep records of the number of passengers carried. They also may make arrival and departure announcements and prepare the weather forms that pilots use when they plan their routes.

Places of Employment

About 45,000 men and women were employed as traffic agents and clerks by the scheduled airlines in 1970. A few thousand others also were employed by the supplemental airlines, and by foreign-flag airlines that operate between the United States and overseas points.

Traffic staffs are employed principally in downtown offices and at airports in or near large cities where most airline passenger and cargo business originates. Some are employed in smaller communities where airlines have scheduled stops.

Training, Other Qualifications, and Advancement

Traffic agents and clerks must deal directly with the public, either in person or by telephone. For this reason, airlines have strict hiring standards with respect to appearance, personality, and education. A good speaking voice is essential because these employees frequently use the telephone or public address systems. High school graduation generally is required, and college training is considered desirable.

College courses in transportation such as "traffic management" and "air transportation," as well as experience in other areas of air transportation, are helpful for a higher grade job, such as traffic representative. Both men and women are employed as reservation and ticket agents; however, most operations agents are men.

Traffic agents may advance to traffic representative and supervisor. A few eventually may move up to city and district traffic and station manager.

Employment Outlook

Employment of traffic personnel will increase rapidly over the 1970's, mainly because of anticipated growth in passenger and cargo traffic. In addition to growth, additional opportunities will arise as young women leave their jobs to marry or rear children.

Most of the major airlines are installing new machines to record and process reservations, keep records, and perform a variety of other routine tasks. Mechanization will affect the reservation clerks in particular. The employment of ticket agents, however, whose main job involves personal contacts, will not be affected very much, although their paper work will be reduced considerably. The small group of traffic representatives probably will increase substantially as the airlines compete for new business.

Earnings and Working Conditions

Limited wage data collected from union-management contracts covering reservations and ticket agents employed by several airlines indicate that their beginning salaries ranged from $495 to $674 a month in 1970. Those workers having 5 years or more of experience earned between $605 to $771 a month. Station and operations agents started between $510 and $695 a month and progressed to about $854 a month after several years.

Many reservation and transportation agents belong to labor unions. Four unions cover most of the organized agents: the Air Line Employees Association International, the Transport Workers Union of America, the Brotherhood of Railway and Steamship Clerks, Freight Handlers, Express and Station Employees, and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.)

Sources of Additional Information

Air Line Employees Association,
5600 S. Central Ave., Chicago,
Ill. 60638.

(See introductory section for sources of additional information and for general information on supplementary benefits and working conditions.)

OCCUPATIONS IN THE ELECTRIC POWER INDUSTRY

Many types of workers are needed to produce electricity, develop additional markets for it, and distribute it to the consumer. These workers include power plant operators, linemen, electricians, engineers, research scientists, salesmen, technicians, meter readers, and office workers. Electric utilities offer interesting jobs and steady employment for men and women in several thousand communities throughout the country.

Nature and Location of the Industry

The electric power industry includes about 3,700 electric utility systems that vary greatly in size and type of ownership. Utilities range from large, interconnected systems serving broad regional areas to small power companies serving individual communities. Most utilities are investor owned (private) or owned by cooperatives; others are owned by cities, counties, and public utility districts, as well as by the Federal Government. Utility systems include power plants, which generate electric power; substations, which increase or decrease the voltage of this power; and vast networks of transmission and distribution lines.

The delivery of electricity to the user at the instant he needs it is the distinctive feature of the operation of electric power systems. Electricity cannot be stored efficiently but must be used as it is produced. Because a customer can begin or increase his use of electric power at any time by merely flicking a switch, an electric utility system must have sufficient capacity to meet peak consumer needs at any time.

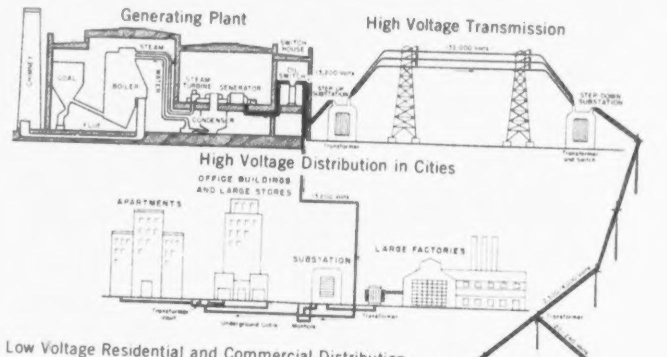
Some utilities generate, transmit, and distribute only electricity; others distribute both electricity and gas. This chapter is concerned with employment opportunities in those jobs relating only to the production and distribution of electric power.

In 1970, an estimated 495,000 privately owned utilities and cooperatives employed about 425,000 of these workers; Federal, and municipal government utilities employed an additional 70,000. A few large manufacturing establishments, which produce electric power for their own use, also employ electric power workers.

Three principal groups of consumers purchased more than 95 percent of all electricity sold in 1970. Industrial customers, such as chemical and aluminum plants, purchased almost 45 percent of all the electric power sold. Residential customers purchased about 30 percent, and commercial customers, such as stores and hotels, purchased about 20 percent.

Electric utility service now reaches almost every locality and, therefore, electric utility jobs are found throughout the country. Hydroelectric power projects have created jobs even in relatively isolated areas. Most utility jobs, however, are in heavily populated urban areas, especially where there are many industrial users, or where a large utility has its headquarters.

Producing and distributing large quantities of electrical energy involves many processes and activities. The accompanying chart shows how electric energy is generated, and how it travels from the generating station to the users. The first step in providing electrical energy occurs in a generating station or plant, where huge generators convert mechanical energy into electricity. Electricity is produced primarily in steam-powered generating plants which use coal, gas, or oil for fuel. Some new steam generating stations use nuclear energy as a fuel. A considerable amount of electricity also is produced in hydroelectric gener-


㉛ **How electricity is made and brought to the users**

Generating Plant
High Voltage Transmission
CHIMNEY
COAL
BOILER
STEAM
WATER
STEAM TURBINE
GENERATOR
CONDENSER
FLUE
SWITCH HOUSE
OIL SWITCH
13,200 volts
STEP UP SUBSTATION
Transformer
STEP DOWN SUBSTATION
Transformer and Switch
High Voltage Distribution in Cities
OFFICE BUILDINGS AND LARGE STORES
APARTMENTS
SUBSTATION
LARGE FACTORIES
Transformer Vault
Underground Cable
Manhole
Transformer
Low Voltage Residential and Commercial Distribution
120/240 volts
HOMES
STORES
SCHOOLS
FARMS

ating stations which use water power to operate the turbines. Some generators, primarily for use in standby service or to provide electricity for special purposes, are powered by diesel or gas turbine engines.

After electricity is generated, it passes through a "switchyard" where the voltage is increased so that the electricity may travel long distances without excessive loss of power. After leaving the generating plant, electricity passes onto transmission lines. These lines carry electricity from the generating plant to substations, where the voltage is decreased and passed on to the distribution networks serving individual customers. Transmission lines tie together the generating stations of a single system and also the power facilities of several systems. In this way, power can be interchanged among several utility systems to meet varying demands.

Electric Utility Occupations

Workers are needed in many different occupations to produce electric power. About 10 percent of the employees in this industry work in occupations directly related to the generation of electricity. About 20 percent are in jobs related to the transmission and distribution of power to the customers. Another 20 percent are in maintenance and repair work and in jobs such as guard and janitor. Approximately 30 percent are employed in administrative and clerical jobs, 10 percent in customer service jobs, and 10 percent in scientific, engineering, and other technical occupations.

In addition to the powerplant, transmission, and customer service occupations (discussed in detail later in this chapter), the industry employs large numbers of workers in maintenance, engineering, scientific, administrative, sales, and clerical occupations. The latter occupations are discussed briefly below. Detailed discussions of these and other occupations in the electric power industry and in many other industries are given in the *Handbook* sections covering the individual occupations.

Maintenance Occupations. A considerable number of workers maintain and repair equipment. The duties of these skilled craftsmen are similar to those of maintenance workers in other industries. Among the more important skilled workers are electricians, instrument repairmen, maintenance mechanics, machinists, pipefitters, and boilermakers.

Engineering and Scientific Occupations. Many job opportunities are available for engineers and technical workers in electric utilities. Engineers plan generating plant additions, interconnections of complex power systems, and installations of new transmission and distribution equipment. They supervise construction, develop improved operating methods, and test the efficiency of the many types of electrical equipment. In planning modern power systems, engineers select plant sites, types of fuel, and types of plants. Engineers also help industrial and commercial customers make the best use of electric power. They stimulate greater use of electricity by demonstrating the advantages of electrical equipment and suggesting places where electricity can be used more effectively.

Administrative and Clerical Occupations. Because of the enormous amount of recordkeeping necessary to run the business operations, electric utilities employ a higher proportion of administrative and clerical personnel than many other industries. Nearly one-third of the industry's work force is employed in clerical and administrative jobs. Many of these workers are women. Large numbers of stenographers, typists, bookkeepers, office machine operators, file clerks, accounting and auditing clerks, and cashiers are employed. These workers keep records of the services rendered by the company, make up bills for customers, and prepare a variety of statements and statistical reports. An increasing amount of this work in the larger offices now is being performed by electronic data-processing equipment. This generally results in more clerical work being done with the same or fewer employees. The use of this equipment also creates requirements for programers and computer operators. Administrative employees include accountants, personnel officers, purchasing agents, and lawyers.

Employment Outlook

Although the production of electric power will increase substantially through the 1970's, employment is expected to grow slowly. In addition to new jobs created by employment growth, several thousand job opportunities will occur each year because of the need to replace workers who retire, die, or leave the industry for other work.

Industrial customers are expected to use more electricity because of the widening application of electric power to industrial processes. Use of electricity by residential customers is expected to rise because of the growth in population and the number of households. In addition, residential customers are expected to increase their use of electricity for heating and air conditioning, and for an increasing number and variety of appliances. The construction of new stores and office buildings and the modernization of existing structures will expand the use of electricity by commercial customers.

However, the growing use of automatic controls in this highly mechanized industry makes possible large increases in the production of electric power with little increase in employment. For example, since operators in generating stations are needed chiefly to check gages and control instruments, improvements in generating equipment have made possible great increases in the industry's capacity and production with only small increases in the number of operators. Continuing development of larger and more highly mechanized equipment with many automatic controls will result in a decline in the number of these operators. The employment of substation operators will continue to decline because of the installation of completely automatic equipment in all but the largest substations. Employment decreases in these occupations may be offset by the expected growth in the number of maintenance and repair craftsmen needed to keep the industry's increasing amount of complex machinery in operating condition.

The employment of workers in maintenance and repair of transmission and distribution lines is expected to remain relatively stable. Fewer men per crew will be needed to work on electric power lines because of the increasing use of mechanized equipment for setting poles and for stringing and maintaining lines. However, this reduction in jobs per crew may be offset by the larger number of crews needed to service the expanding distribution systems required by the growing number of electric power customers.

Because of the increasing use of electronic data-processing equipment for billing and record-keeping, only a small increase in office employment is expected. However, the relatively high turnover in office jobs will provide many additional openings for new workers each year. Some increase in employment also is expected in administrative jobs; scientific, engineering, and other technical jobs; and in areas such as sales and market development.

Earnings and Working Conditions

Earnings in the electric utility industry generally are higher than in other public utility industries and in many manufacturing industries. In 1970, nonsupervisory employees in private electric power utilities averaged $175.98 for a 41.8 hour week, or $4.21 an hour.

Many nonsupervisory electric utility workers in production, transmission, and distribution departments are union members. The bargaining representative for most of these workers is either the International Brotherhood of Electrical Workers or the Utility Workers Union of America. Independent unions represent some utility workers.

Because supplying electricity is a 24-hour, 7-day-a-week activity, some employees work evenings, nights, and weekends. Most union contracts with electric utilities provide a higher rate of pay for evening and night work than the basic day rate. In 1970, most workers on the second shift received from 4 to 26.5 cents an hour more than the basic day rate, and those on the third shift, from 6 to 39.5 cents an hour more.

Overtime work often is required, especially during emergencies such as floods, hurricanes, or storms. During an "emergency callout," which is a short-notice request to report to work during nonscheduled hours, the worker generally is guaranteed a minimum of 3 or 4 hours' pay at 1½ times his basic hourly rate. Travel time to and from the job is counted as worktime.

In addition to these provisions which affect pay, electric utilities provide other employee benefits. Annual vacations are granted to workers according to length of service. Usually, contracts or employee benefit programs provide for a 1-week vacation for 6 months to 1 year of service, 2 weeks for 1 to 10 years, and 3 weeks for 10 to 20 years. A number of contracts and programs provide for 4 weeks after 18 years and for 5 weeks after 25 years or more. The number of paid holidays ranges from 6 to 12 days a year. Nearly all companies have benefit plans for their employees. A typical program provides life, hospitalization, and surgical insurance and paid sick leave. Retirement pension plans supplement Federal social security payments and generally are paid for in full or in part by the employer.

The number of injuries per million man-hours worked is much lower in this industry than in most manufacturing industries. Some occupations are more subject to accidents than others. Accidents occur most frequently among the line and cable splicing crews. Because of the dangers of electrocution and other hazards, electric utilities and unions have made intensive efforts to enforce safe working practices.

Sources of Additional Information

More information about jobs in

the electric power industry may be obtained from local electric utility companies, industry trade associations, or from the local offices of unions which have electric utility workers among their membership. Additional information may be obtained from:

Edison Electric Institute, 750 3rd Avenue, New York, New York 10017.

International Brotherhood of Electrical Workers, 1200 15th St. NW., Washington, D.C. 20005.

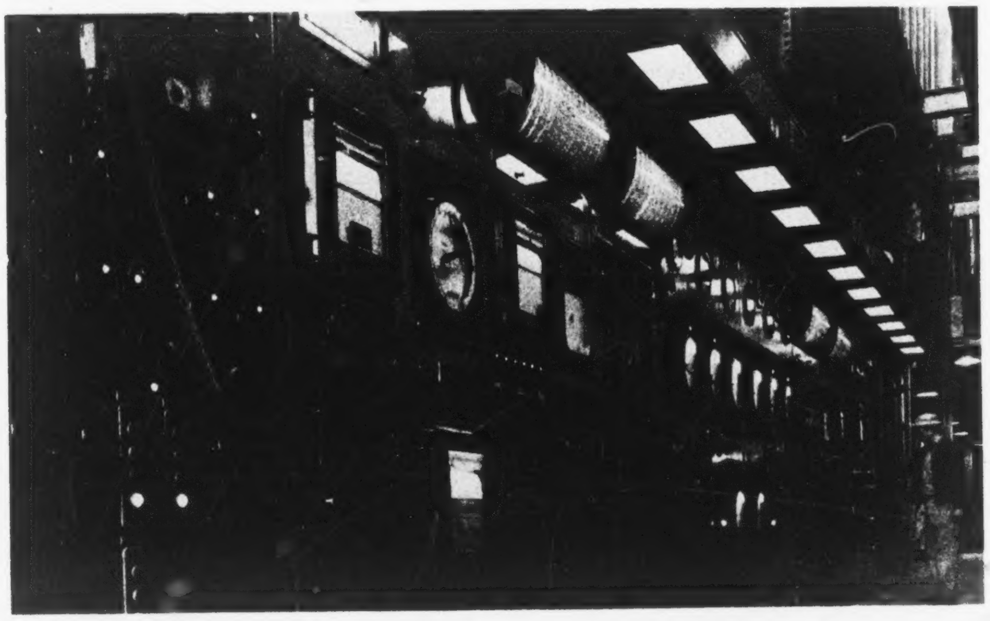
Utility Workers' Union of America, 1875 Conn. Ave. NW., Washington, D.C. 20006.

POWERPLANT OCCUPATIONS

Nature of the Work

Operators are key workers in a powerplant. They observe, control, and keep records of the operation of various kinds of powerplant equipment. They make sure the equipment functions efficiently and detect any trouble that arises. There are four basic classes of operators —boiler, turbine, auxiliary equipment, and switch-board operators. In many new steam plants, the duties of these operators are combined, and operators and their assistants are known as steam operators, powerplant operators, or central control room operators. Of increasing importance in this highly mechanized industry are the maintenance men and repairmen, including electrical, instrument, and mechanical repairmen. Other powerplant workers include helpers and cleaners, and the custodial staff, including janitors and watchmen. Coal handlers are employed in steam generating plants that use coal for fuel. Hydroelectric plants employ gate tenders who open and close the headgates that control the flow of water to the turbines. Supervision of powerplant operations is handled by a chief engineer and by his assistants, the watch engineers.

Boiler operators (D.O.T. 950.782) regulate the fuel, air, and water supply in the boilders and maintain proper steam pressure needed to turn the turbines, on the basis of information shown by gages, meters, and other instruments mounted on panel boards. One man may operate one or more boilers. Boiler operators, are employed only where steam is used to generate electricity.



Turbine operators (D.O.T. 952.138) control the operation of steam- or water-powered turbines which drive the generators. (In small plants, they also may operate auxiliary equipment or a switchboard.) Modern steam turbines and generators operate at extremely high speeds, pressures, and temperatures; therefore, close attention must be given the pressure gages, thermometers, and other instruments which show the operations of the turbogenerator unit. Turbine operators record the information shown by these instruments and check the oil pressure at bearings, the speed of the turbines, and the circulation and amount of cooling water in the condensers which change the steam back into water. They also are responsible for starting and shutting down the turbines and generators, as directed by the switchboard operator in the control room. Other workers, such as helpers and junior operators, assist the turbine operators.

Auxiliary equipment operators (D.O.T. 952.782) check and record the readings of instruments that indicate the operating condition of pumps, fans, blowers, condensers, evaporators, water conditioners, compressors, and coal pulverizers. Since auxiliary equipment may break down occasionally, these operators must be able to detect trouble quickly, make accurate judgments, and sometimes make repairs. Some small plants do not employ auxiliary equipment operators; these duties are performed by turbine operators.

Switchboard operators (D.O.T.

952.782) control the flow of electric power in the generating station from generators to outgoing powerlines. They usually work in a control room equipped with switchboards and instrument panels. Switches control the movement of electricity through the generating station circuits and onto the transmission lines.

Instruments mounted on panelboards show the power demands on the station at any instant, the powerload on each line leaving the station, the amount of current being produced by each generator, and the voltage. The operators use switches to distribute the power demands among the generators in the station, to combine the current from two or more generators, and to regulate the flow of the electricity onto various powerlines to meet the demands of the users served by each line. When power requirements on the station change, they order generators started or stopped and, at the proper time, connect them to the power circuits in the station or disconnect them. In doing this work, they follow telephone orders from the load dispatcher who directs the flow of current throughout the system.

Switchboard operators and their assistants also check their instruments frequently to see that electricity is moving through and out of the powerplant properly, and that correct voltage is being maintained. Among their other duties, they keep records of all switching operations and of load conditions on generators, lines, and transformers. They obtain this information by making regular meter readings.

In most powerplants constructed in recent years, the operation of boilers, turbines, auxiliary equipment, and the switching required for efficient balancing of generator output has been centralized in a single control room. Here, central control room operators or power plant operators, by monitoring instrument panels and manipulating switches, regulate all the power generating equipment, which in older plants requires specialists such as boiler and turbine operators. Control room operators have several assistants who patrol the plant and check the equipment. The central control room operators report to the plant superintendent or watch engineers when equipment is not operating properly.

Watch engineers (D.O.T. 950.131) the principal supervisors in a powerplant oversee the employees who operate and maintain boilers, turbines, generators, auxiliary equipment, switchboards, transformers, and other machinery and equipment. Watch engineers are supervised by a chief engineer or a plant superintendent who is in charge of the entire plant.

Training, Other Qualifications, and Advancement

New powerplant workers generally begin at the bottom of the ladder—usually on cleanup jobs. Such work gives beginners an opportunity to become familiar with the equipment and the operations of a powerplant. They advance to the more responsible job of helper, as job openings occur. Formal apprenticeships in these jobs are rare. Applicants generally are required to have a high school education or its equivalent. Advancement on the job de-

pends primarily on one's ability to master the skills required.

It takes from 1 to 3 years to become an auxiliary equipment operator and from 4 to 8 years to become a boiler operator, turbine operator, or switchboard operator. A person leaning to be an auxiliary equipment operator progresses from helper to junior operator to operator. A boiler operator generally spends from 2 to 6 months as a laborer before being promoted to the job of helper. Depending on openings and the worker's aptitude, the helper may advance to junior boiler operator and eventually to boiler operator, or transfer to the maintenance department and work his way up to boiler repairman. In most large cities, boiler operators, who operate high-pressure boilers, are required to be licensed.

Powerplant workers employed in atomic-powered electric plants must have special training to work with fissionable, radioactive fuel, in addition to the knowledge and skills required for conventional steam generated electric power.

Turbine operators are selected from among auxiliary equipment operators in many plants. The line of advancement in other plants is from laborer to turbine helper. The helper then may advance either to junior turbine operator and eventually to turbine operator, or he may transfer to turbine repairman, depending on job openings and his aptitude. Turbine operators in most large cities are required to be licensed.

Where a system has a number of generating plants of different size, operators first get experience in the smaller stations and then are promoted to jobs in the larger stations as vacancies occur. New workers in the switchboard operators section begin as helpers, advance to junior operators, and then to switchboard operators. They also may advance from jobs in small stations to those in larger stations where operating conditions are much more complex. Some utility companies promote substation operators to switchboard operating jobs. The duties of both classes of operators have much in common. Switchboard operators can advance to work in the load dispatcher's office.

Watch engineers are selected from among experienced powerplant operators. At least 5 to 10 years of experience as a first-class operator usually are required to qualify for a watch engineer's job.

Employment Outlook

The total number of jobs for powerplant operators is expected to show little change through the 1970's, although the production of electrical energy will increase at a rapid rate. However, several hundred job openings will occur each year because of the need to replace operators who retire, die, or leave the industry for other work.

The use of increasingly larger and more efficient equipment is expected to make possible great increases in capacity and production with little increase in the number of powerplant operators. For example, one operator can control a large modern turbogenerator as readily as he can control a much smaller one. Also, the growing use of more automatic equipment reduces the number of operators needed, and makes it possible to direct all operating processes from a central control room. However, because of the expected increased demand for electric power, it will be necessary to build and operate many new generating stations.

Generally, operating a nuclear-powered plant required about the same number of employees as running a steam-generating plant using fossil fuels.

Earnings and Working Conditions

The earnings of powerplant workers depend on the type of job, the section of the country in which they work, and many other factors. The following tabulation shows estimated average hourly earnings for selected powerplant occupations in privately operated utilities in 1970:

	Average hourly earnings
Auxiliary equipment operator	$4.14
Boiler operator	4.80
Control room operator	5.28
Switchboard operator:	
Switchboard operator, Class A	4.92
Switchboard operator, Class B	4.35
Turbine operator	4.71
Watch engineer	5.54

A powerplant is typically well lighted and ventilated, clean, and orderly, but there is some noise from the whirring turbines.

Switchboard operators in the control room often sit at the panel boards, but boiler and turbine operators are almost constantly on their feet. The work of powerplant operators generally is not physically strenuous, particularly in the newer powerplants. Since generating stations operate 24 hours a day, 7 days a week, powerplant employees sometimes must work nights and weekends.

TRANSMISSION AND DISTRIBUTION OCCUPATIONS

Nature of the Work

One-fifth of the workers employed by electric light and power systems are in transmission and distribution jobs maintaining the flow of electric power to the users. The principal workers in transmission and distribution jobs are those who control the flow of electricity—load dispatchers and substation operators—and the men who construct and maintain powerlines—linemen, cable splicers, troublemen, groundmen, and helpers. Linemen make up the largest single occupation in the industry.

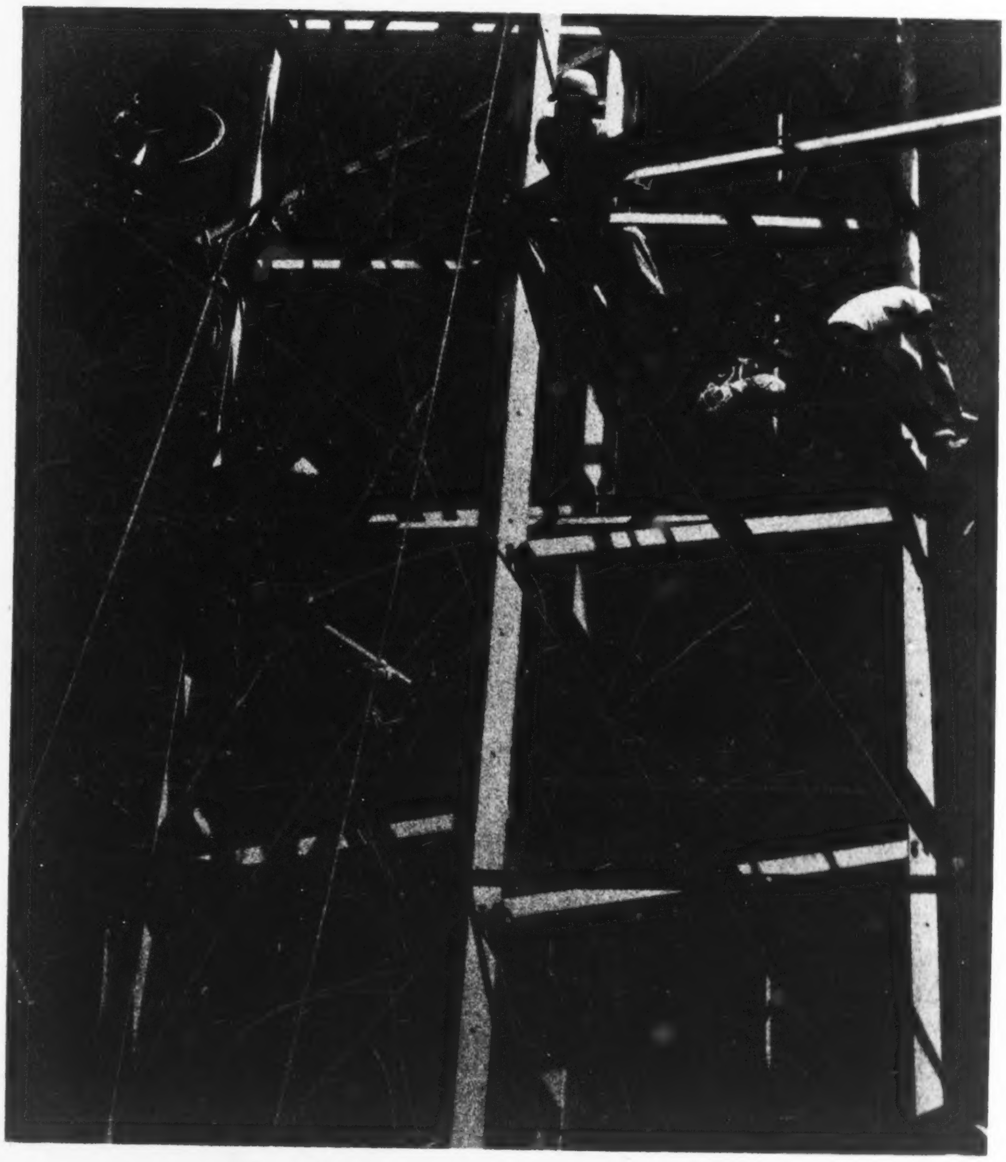
Load dispatchers (D.O.T. 950.168) (sometimes called system operators or power dispatchers) are the key operating workers of the transmission and distribution departments. They control the flow of electricity throughout the area served by the utility. The load dispatcher's room is the nerve center of the entire utility system. From this location, he controls the plant equipment used to generate electricity and directs its flow throughout the system. He telephones his instructions to the switchboard operators at the generating plants and the substations. He tells the operators when additional boilers and generators are to be started or stopped in line with the total power needs of the system.

The load dispatcher must anticipate demands for electric power so that the system will be prepared to meet them. Power demands on utility systems may change from hour to hour. A sudden afternoon rainstorm can cause a million lights to be switched on in a matter of minutes.

He also directs the handling of any emergency situation, such as a transformer or transmission line failure, and routes current around the affected area. Load dispatchers also may be in charge of interconnections with other systems, and they direct the transfer of current between systems as the need arises.

The load dispatcher's source of information for the entire transmission system centers in the pilot board. This pilot board, which dominates the load dispatcher's room, is a complete map of the utility's transmission system. It enables the dispatcher to determine, at a glance, the conditions that exist at any point in the system. Lights may show the positions of switches which control generating equipment and transmission circuits, as well as high voltage connections with substations and large industrial customers. The board also may have several recording instruments which make a graphic record of operations for future analysis and study.

Substation operators (D.O.T. 952.782) generally are responsible for the operation of the substation. Under orders from the load dispatcher, they direct the flow of current out of the station by means of a



switchboard. Ammeters, voltmeters, and other types of instruments on the switchboard register the amount of electric power flowing through each line. The flow of electricity from the incoming to the outgoing lines is controlled by circuit breakers. The substation operators connect or break the flow of current by manipulating levers on the switchboard which control the circuit breakers. In some substations, where alternating current is changed to direct current to meet the needs of special users, the operator controls converters which perform the change.

In addition to switching duties, the substation operators check the operating condition of all equipment to make sure that it is in good working condition. They supervise the activities of the other substation employees on the same shift, assign them tasks, and direct their work. In smaller substations, the substation operator may be the only employee.

Linemen (D.O.T. 821.381) construct and maintain the network of powerlines which carry electricity from generating plants to consumers. Their work consists of installations, equipment replacements, repairs, and routine maintenance work. Although in many companies the installation of new lines and equipment is important, in other companies this work is performed by outside contractors. When wires, cables, or poles break, it means an emergency call for a line crew. Linemen splice or replace broken wires and cables and replace broken insulators or other damaged equipment. Most linemen now work from "bucket" trucks with pneumatic lifts that take them to the top of the pole or adjacent to the overhead conductor at the touch of a lever.

In some power companies, linemen specialize in particular types of work. Those in one crew may work only on new construction, and others may do only repair work. In some instances, linemen specialize on high voltage lines using special "hot line" tools to avoid interruptions in the flow of current.

Troublemen (D.O.T. 821.281) are experienced linemen who are assigned to special crews that handle emergency calls for service. They move from one special job to another, as ordered by a central service office which receives reports of line trouble. Often troublemen receive their orders by direct radio communication with the central service office.

These workers must have a thorough knowledge of the company's transmission and distribution network. They first locate and report the source of trouble and then attempt to restore service by making the necessary repairs. Depending on the nature and extent of the trouble, a troubleman may restore service in the case of minor failure, or he may simply disconnect and remove damaged equipment. He must be familiar with all the circuits and switching points so that he can safely disconnect live circuits in case of line breakdowns.

Groundmen (D.O.T. 821.887) dig poleholes and assist the linemen and apprentices to erect the wooden poles which carry the distribution lines. The linemen bolt crossarms to the poles or towers and bolt or clamp insulators in place on the crossarms. With the assistance of the groundmen, they raise the wires and cables and install them on the poles or towers by attaching them to the insulators. In addition, with assistance from groundmen, linemen attach a wide variety of equipment to the poles and towers, such as lightning arrestors, transformers, and switches.

Cable splicers (D.O.T. 829.381) install and repair single- and multiple-conductor insulated cables on utility poles and towers, as well as those buried underground or installed in underground conduits. When cables are installed, the cable splicers pull the cable through the conduit and then join the cables at connecting points in the transmission and distribution systems. At each connection in the cable, they wrap insulation around the wiring. They splice the conductors leading away from each junction of the main cable, insulate the splices, and connect the cable sheathing. Many cables have a lead sheath which requires making a lead joint. Most of the physical work in placing new cables or replacing old cables is done by helpers.

Cable splicers spend most of their time repairing and maintaining the cables and changing the layout of the cable systems. They must know the arrangement of the wiring systems, where the circuits are connected, and where they lead to and come from. They make sure that the conductors do not become mixed up between the substation and the customer's premises. The splicers connect the ends of the conductor to numbered terminals, making certain that they have the same identifying number at the remote panel box in an underground vault as they have in the control office. Cable splicers also make sure the insulation on the cables is in good condition.

Training, Other Qualifications, and Advancement

Load dispatchers are selected from among the experienced switchboard operators and from operators of the larger substations. Usually, 7 to 10 years of experience as a senior switchboard or substation operator are required for promotion to load dispatcher. To qualify for this job, an applicant must demonstrate his knowledge of the entire utility system.

Substation operators generally begin as assistant or junior operators. Advancement to the job of operator in a large substation requires from 3 to 7 years of on-the-job training.

Skilled linemen (journeymen) usually qualify for these jobs after about 4 years of on-the-job training. In some companies, this training consists of a formal apprenticeship program. Under formal apprenticeship, there is a written agreement, usually worked out with a labor union, which covers the content of the training and the length of time the apprentice works in each stage of the training. The apprenticeship program combines on-the-job training and classroom instructions in blue-print reading, elementary electrical theory, electrical codes, and methods of transmitting electrical currents.

The apprentice usually begins his training by helping the groundman to set poles in place and by passing tools and equipment up to the lineman. After a training period of approximately 6 months, the apprentice begins to do simple linework on lines having low voltage. While performing this work, he is under the immediate supervision of a journeyman lineman or the line foreman. After about a year, he is assigned more difficult work but is still under close supervision. During the last 6 months of his apprenticeship, the trainee does about the same kind of work as the journeyman lineman but with more supervision. When he begins to work independently, he is first assigned simple, routine tasks. After he acquires several years of experience and demonstrates a thorough knowledge of the company's transmission and distribution systems, he may advance from lineman to troubleman.

The training of linemen who learn their skills on the job generally is similar to the apprenticeship program; it usually takes about the same length of time but does not involve classroom instruction. The worker begins as a groundman and progresses through increasingly difficult stages of linework before becoming a skilled lineman.

Candidates for linework should be strong, in good physical condition, and without fear of height. Climbing poles and lifting lines and equipment is strenuous work. They also must have steady nerves and good balance to work at the tops of the poles and to avoid the hazards of live wires and falls.

Most cable splicers get their training on the job, usually taking about 4 years to become fully qualified. Workers begin as helpers and then are promoted to assistant or junior splicers. In these jobs, they are assigned more difficult tasks as their knowledge of the work increases.

Employment Outlook

Several thousand job opportunities are expected to be available in transmission and distribution occupations through the 1970's. Most of these opportunities will occur because of the need to replace experienced workers who retire, die, or transfer to other fields of work.

Some increase in the employment of transmission and distribution workers is expected, although employment trends will differ among the various occupations in this category. In spite of the need to construct and maintain a rapidly growing number of transmission and distribution lines, the number of linemen and troublemen is expected to increase only slightly because of the use of more mechanized equipment. Some increase in the number of cable splicers is expected because of the growing use of underground lines in suburban areas. The need for substation operators will be reduced substantially, since the introduction of improved and more automatic equipment makes it possible to operate most substations by remote control.

Earnings and Working Conditions

The earnings of transmission and distribution workers depend on the type of job they have, and the section of the country in which they work. The following tabulation shows the average hourly earnings for major transmission and distribution occupations in privately operated utilities in 1970:

	Average hourly earnings
Groundman	$3.50
Lineman	5.05
Load dispatcher	5.74
Substation operator	4.63
Troubleman	5.27

Load dispatchers and substation operators generally work indoors in pleasant surroundings. Linemen, troublemen, and groundmen work outdoors and, in emergencies, in all kinds of weather. Cable splicers do most of their work in manholes beneath city streets—often in cramped quarters. Safety standards developed over the years by utility companies, with the cooperation of labor unions, have reduced greatly the accident hazards of these jobs.

CUSTOMER SERVICE OCCUPATIONS

Nature of the Work

Workers in customer service jobs include those who install, test, and repair meters, and those who read the meters. Also in this group are company agents in rural areas and appliance servicemen working in company-operated shops which repair electrical equipment owned by customers.

Metermen (D.O.T. 729.281) (or meter repairmen) are the most skilled workers in this group. They install, test, maintain, and repair meters on customers' premises, particularly those of large industrial and commercial establishments. Some metermen can handle all types of meters, including the more complicated ones used in industrial plants and other places where large quantities of electric power are used. Others specialize in repairing the simpler kinds, like those in homes. Often, some of the large systems have meter specialists, such as *meter installers* (D.O.T. 821.381) and *meter testers* (D.O.T. 729.281). Meter installers put in and take out meters. Meter testers specialize in testing the small meters on homeowners' property and some of the more complicated ones used by commercial and industrial customers.

Meter readers (D.O.T. 239.588) go to customers' premises—homes, stores, and factories—to read meters which register the amount of electric current used. They record the amount of current used in a specific period so that each customer can be charged for the amount he used. Meter readers also watch for, and report, any tampering with meters.

District representatives usually serve as company agents in outlying districts which are too small to justify the use of more specialized workers. They collect overdue bills, make minor repairs, and read, connect, and disconnect meters. They receive and send service complaints and reports of line trouble to a central office.

Meter reader checks the amount of electric current used.

Training, Other Qualifications, and Advancement

Metermen begin their jobs as helpers in the meter testing and meter repair departments. Young men entering this field should have a basic knowledge of electricity. About 4 years of on-the-job training are required to become a fully qualified meterman. Some companies have formal apprenticeship programs for this occupation in which the trainee progresses according to a specific plan.

Utility companies usually employ inexperienced men to work as meter readers. They generally accompany the experienced meter reader on his rounds until they have learned the job well enough to go on the rounds alone. This job can be learned in a few weeks.

The duties of district representatives are learned on the job. An important qualification for men in these jobs is the ability to deal tactfully with the public in handling service complaints and collecting overdue bills.

Employment Outlook

Little change in employment in customer service occupations is expected through the 1970's. The need for meter readers will be limited because of the trend toward less frequent reading of meters. Moreover, automatic meter reading may become more common, and new meters will require less maintenance. However, some job openings for metermen and meter readers will occur each year to replace those workers who retire, die, or transfer to other fields of work.

Earnings and Working Conditions

The earnings of customer service workers vary according to the type of job they have, and the section of the country in which they work. The following tabulation shows the average hourly earnings for major customer service jobs in privately operated utilities in 1970:

	Average hourly earnings
District representative	$5.18
Meterman A	4.97
Meterman B	4.44
Appliance serviceman	3.83
Meter reader	4.61

The job of the meter reader is not physically strenuous but involves considerable walking and some stair climbing. Metermen and appliance servicemen work indoors under typical repair shop conditions except when repairing or installing meters or appliances on customers' premises.

MERCHANT MARINE OCCUPATIONS

The American merchant marine is a vital link in the Nation's transportation system. It is our life-line in both peace and war and links us to every corner of the world. It transports America's exports and, in return, brings imports from the rest of the world. In time of conflict, it carries troops, arms, and supplies to combat areas. Seafaring employment offers a wide variety of interesting and rewarding careers as well as travel and adventure.

Nature and Location of the Industry

The U.S. Flag Merchant Fleet consists of ocean-going vessels of 1,000 gross tons or over which carry U.S. foreign and domestic water-borne commerce. In late 1970, about 7 out of every 8 of the approximately 770 ships in the active fleet were privately owned. Government-owned ships are operated by the Navy's Military Sealift Command (MSC) which has civilian seafaring personnel.

Three broad categories of ships constitute the merchant fleet: combination passenger-cargo vessels, tankers, and freighters. Ships in our "liner fleet" operate on regular schedules to specific ports. "Tramp" ships, on the other hand, sail for any port promising cargoes.

This country's 10 combination passenger-cargo ships carry passengers, mail, and highly valued cargo on a regularly scheduled basis. Its approximately 255 tankers carry liquid bulk products, primarily petroleum and petroleum products, almost exclusively in the domestic trade between Gulf Coast ports and Atlantic Coast ports. The more than 500 freighters, on the other hand, are employed almost exclusively in foreign trade. More than half of the freighters are employed in liner service to carry relatively high valued packaged cargoes on fixed schedules. Freighters are of various types, including general cargo ships, and special purpose vessels such as bulk carriers and roll-on-roll-off container ships.

Places of Employment

The U.S. Flag Merchant Fleet employed about 42,000 officers and seamen in mid-1970, more than 90 percent of whom were on freighters and tankers. Many additional men were employed during the year because many seamen leave their ships at the termination of a voyage; some take vacations which may average 100 days or more each year; others take temporary shoreside jobs or are unavailable for sea duty because of illness or injury.

Although the United States has about 70 ports, more than half of the Nation's shipping is carried on in 17 deep-sea ports along the Atlantic, Gulf, and Pacific Coasts. The Nation's largest port is New York. Other major Atlantic ports are Philadelphia, Baltimore, Norfolk, Boston, Charleston, Savannah, Tampa, and Jacksonville. Gulf ports handling substantial volumes of cargo include New Orleans, Houston, Galveston, Port Arthur, and Lake Charles. Shipping on the West Coast is concentrated in the areas of San Francisco Bay, Los Angeles, Seattle, and Portland.

The size and composition of crews depend on the size and type of vessel. Cargo ships and tankers have crews varying from 36 to 65 men; passenger ships may have a crew of 300 or more.

The work aboard ship is divided among the deck, engine, and steward departments. The deck department is responsible for navigation, maintenance of the hull and deck equipment, and the supervision of loading, discharging, and storing of cargo. Personnel in the engine department operate and maintain the machinery that propels the vessel. The steward's department feeds the crew and maintains living and recreation areas.

About one-fourth of the jobs in the merchant marine are filled by officers. The remaining jobs are filled by skilled, semiskilled, and unskilled seamen.

Training, Other Qualifications, and Advancement

No educational requirements are established for jobs in the merchant marine industry, but a good education is a definite advantage. Formal training for officers is conducted at the U.S. Merchant Marine Academy, at five State merchant marine academies, and through programs operated by trade unions. Unions also conduct training programs to upgrade the ratings of seamen and, to a limited degree, to train prospective seamen for entry ratings.

To obtain an officer's license, a candidate must be a U.S. citizen, physically fit, and pass a comprehensive written examination administered by the U.S. Coast Guard. Seamen must also obtain a license (merchant mariner's document) from the Coast Guard. An applicant must present proof that he has a job offer aboard a U.S. merchant vessel and pass a physical examination.

The prospective mariner should give serious thought to the department (deck, engine, steward) in which he would like to work. Once a man starts up the ladder in one department he cannot switch without beginning near the bottom again. Advancement to a higher rating depends not only upon specified sea experience, leadership ability, and an opening, but also upon passing a Coast Guard examination.

A young man who is considering the merchant marine as a career must be able to live and work with others as a team. Although peacetime service is relaxed, he must adjust to some military-like discipline, which is essential because of the nature of shipboard life.

More detailed information on training, other qualifications, and advancement appears in the statements on Licensed Merchant Marine Officers and Unlicensed Merchant Seamen.

Employment Outlook

Except during periods of war and national emergency, there has been a long-term decline in the number of men and vessels in our merchant marine, and more of the same is expected through the 1970's. Nevertheless, some job openings will arise each year from the need to replace experienced men who retire, die, or quit the sea for other reasons. Competition for these openings, however, will be severe because the number of men seeking merchant marine jobs is expected to greatly exceed the number of openings.

Because of substantially higher shipbuilding and labor costs, our merchant fleet finds that competing in the worldwide shipping market is difficult. To insure that our country has a merchant fleet operating in regular or essential trade routes, the Government subsidizes nearly two-fifths of the active fleet or about 300 vessels.

In 1970, the Government enacted legislation to subsidize the construction of 30 new ships annually over a 10-year period and to improve tax incentives for firms to purchase new ships. The number of new ships constructed, however, is not expected to be as great as the number of older ones retired from service each year. Thus, a continued decrease in the size of the fleet is anticipated, unless new innovations that cut shipping costs, such as barge-carrying ships, improve our competitive position in the world market.

Future ships will be larger and faster and will operate with fewer men. For example, a central console in the engineroom of the newest ships controls engines, boilers, and most auxiliary equipment. Data loggers automatically print performance information such as temperatures and pressures of automated boiler systems.

The size of the deck crew is being reduced primarily by technological improvements such as hydraulically operated hatch covers, and automatic tension mooring winches that assist in docking and undocking. Eventually a "lookout" device is foreseen that not only will warn of a collision but also will automatically adjust the course to avoid a crash. Improved efficiency on our newest ship already has cut 11 to 14 men from conventional manning requirements of about 55; still further reductions are likely.

Widespread unemployment will not necessarily accompany reductions in manpower needs. For one thing, the dozen or so seagoing unions are likely to resist substantial cuts in the size of crews. Further, many men began their careers when our fleet was built during World War II. This older work force, in conjunction with liberalized pension provisions and normally high departure rates for shore jobs, is expected to result in a large outflow of men from the industry during the years ahead.

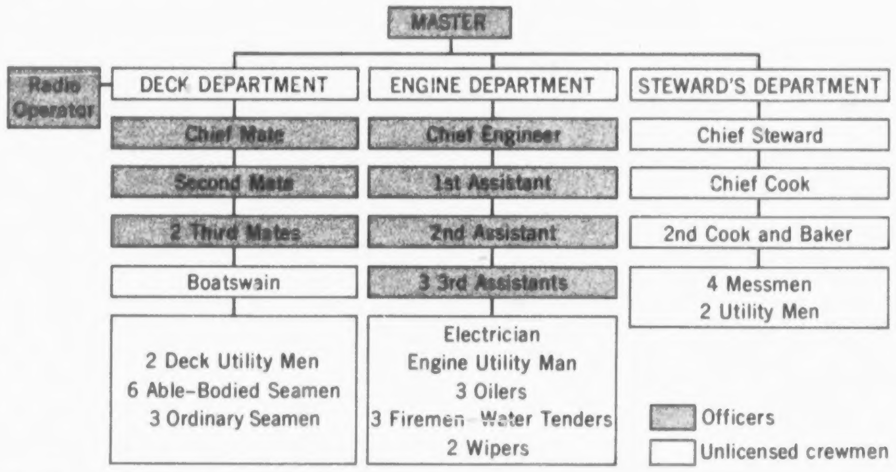
Earnings and Working Conditions

Earnings aboard American flag deep-sea ships are the highest of any Nation in the world. In few other industries can an ambitious man who has a high school education or less do so well financially. A seaman who has advanced a rung or two in rating can receive base and overtime earnings of nearly $800 a month, in addition to free food and lodging. Most officers earn over $1,100 a month.

Wages vary not only according to the job but also by the size and type of vessel. They are highest on large vessels. An outstanding characteristic of the maritime industry is that base wages represent only part of the take-home pay. On the average, additional payments for assuming extra work or responsibility add about 50 percent to base wages.

Liberal employer-financed fringe benefits are provided. Officers and seamen may retire on full pension after 20 years of service, regardless of age. Paid vacations range from 60 to 110 days a year. All men and their dependents are covered by comprehensive medical and welfare benefits. (See statements on Licensed Merchant Marine Officers and Unlicensed Merchant Seamen for more information on earnings.)

The workweek for persons employed aboard ships is considerably different from the workweek of per-


MASTER
Radio Operator
DECK DEPARTMENT
ENGINE DEPARTMENT
STEWARD'S DEPARTMENT
Chief Mate
Second Mate
2 Third Mates
Boatswain
2 Deck Utility Men
6 Able-Bodied Seamen
3 Ordinary Seamen
Chief Engineer
1st Assistant
2nd Assistant
3 3rd Assistants
Electrician
Engine Utility Man
3 Oilers
3 Firemen-Water Tenders
2 Wipers
Chief Steward
Chief Cook
2nd Cook and Baker
4 Messmen
2 Utility Men
Officers
Unlicensed crewmen

(32) Typical crew aboard a dry-cargo ship

SOURCE: BUREAU OF LABOR STATISTICS

sons employed on the shore. At sea, most officers and seamen are required to stand watch. Watchstanders work 7 days a week. Generally, they stand two 4-hour watches (shifts) during every 24-hour period and have 8 hours off between each watch. Some officers and seamen are day workers. They work 8 hours a day, Monday through Friday. Both watchstanders and day workers are paid overtime for work over 40 hours a week. When the ship is in port, the basic workweek is 40 hours.

Working and living conditions aboard ship have improved over the years. Mechanization has reduced physical demands and newer vessels contain private rooms, airconditioning, television, and expanded recreational facilities. However, life aboard ship is confining. Although a man may visit many parts of the world, his shore time may be limited by the increasingly rapid "turn-around" time of modern vessels.

While at sea, crew members must be able to derive satisfaction from simple pleasures, such as reading or a chair-side hobby. Since voyages last several weeks or months, men are away from home and families for substantial periods of time. Some men tire of the lengthy separations and choose shoreside employment. Others become frustrated by periods of unemployment. Although union rules recognize seniority in hiring, a man who has long years of sea experience does not have the same degree of job security often associated with seniority in shore jobs. Available jobs are usually first offered to workers in the highest seniority "level," but employment within these levels is typically on a first-come, first-served basis. When jobs are scarce, the list of candidates may be long.

The duties aboard ship are hazardous relative to other industries. At sea, there is always a possibility of injuries from falls or the danger of fire, collision, or sinking. In the past, sudden illness at sea could be extremely hazardous, but emergency air service available today reduces the danger. Despite these drawbacks, for many men, the spirit and adventure of the sea, good wages and living conditions, and liberal fringe benefits more than compensate for the disadvantages.

LICENSED MERCHANT MARINE OFFICERS

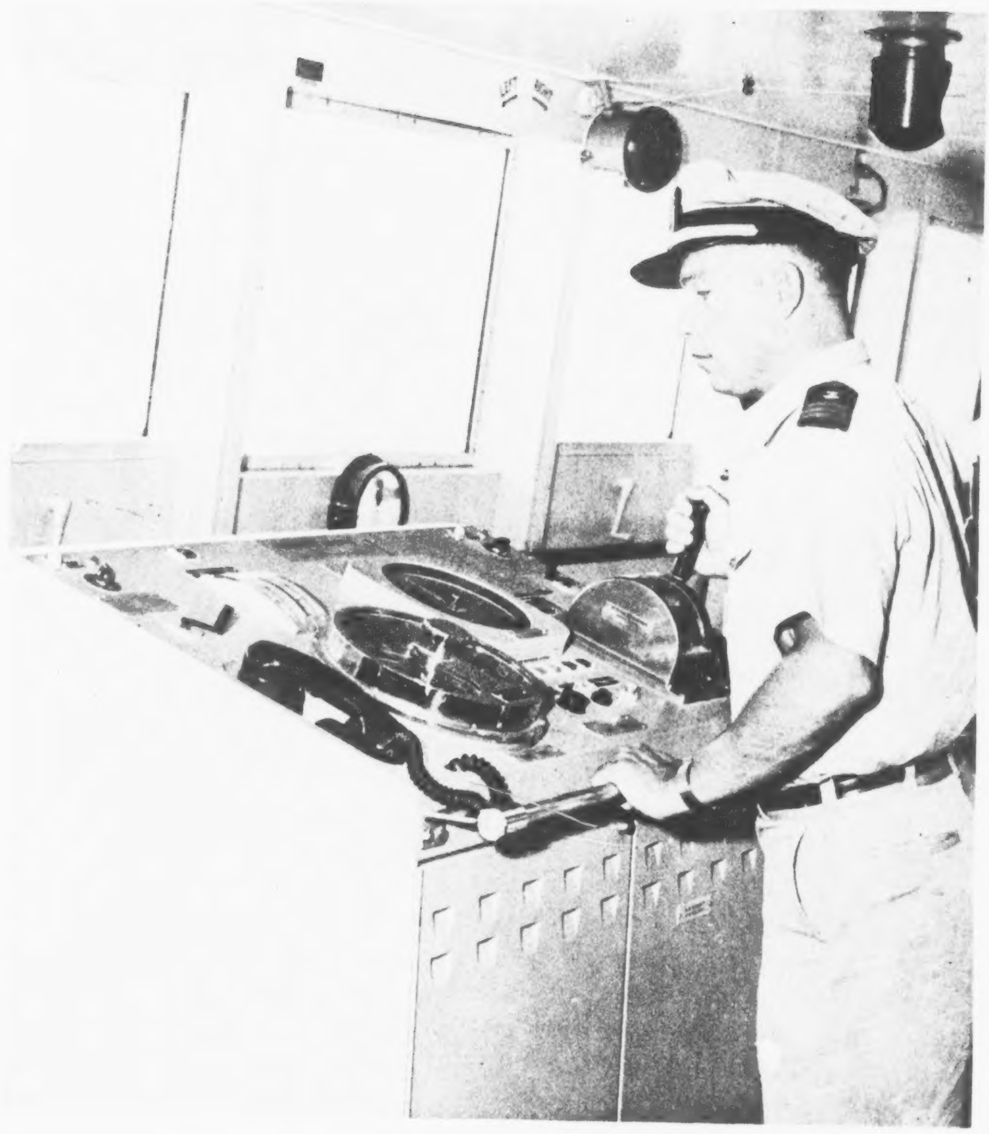
Nature of the Work

The Coast Guard licenses ship's professional and supervisory personnel consisting of deck, engine, and radio officers. In command of every ocean-going vessel is the *captain* (D.O.T. 197.168) or *master* who is the shipowner's sole representative. He has complete authority and responsibility for the operation of the ship, including discipline and order, and the safety of the crew, passengers, cargo, and vessel.

While in port, the captain may function as the agent for the ship owners by conferring with custom officials. In some cases, he may act as paymaster for the ship. Although not technically a member of a specific department, he generally is associated with the deck department, from whose ranks he was promoted.

Deck Department. Acting under supervision of the captain, deck officers or "mates" as they are traditionally called, direct the navigation and piloting of the ship and the maintenance of the deck and hull. American vessels are equipped with modern navigational devices, such as radar, sonar, and radio directional finders. Deck officers must be familiar with these and other instruments to operate ships safely and efficiently.

While on duty, the deck officer maintains the authorized speed and course; plots the vessel's position at



Chief mate directs speed and course of cargo ship.

frequent intervals; posts lookouts when required; records his watch in the ship's "log" of the voyage; and immediately notifies the captain of any unusual occurrences.

Besides acting as watch officer, each deck officer performs other duties. The *chief mate* (D.O.T. 197.133), or first mate or chief officer, as he is also known, is the captain's key assistant in assigning duties to the deck crew and maintaining order and discipline. He also plans and carries out the loading, unloading, and stowing of cargo, and assists the captain in taking the ship in and out of port. On some ships he also may be in charge of first aid treatment.

By tradition, the *second mate* (D.O.T. 197.133) is the navigating officer. He sees that the ship is provided with the necessary navigation charts and that navigating equipment is maintained properly.

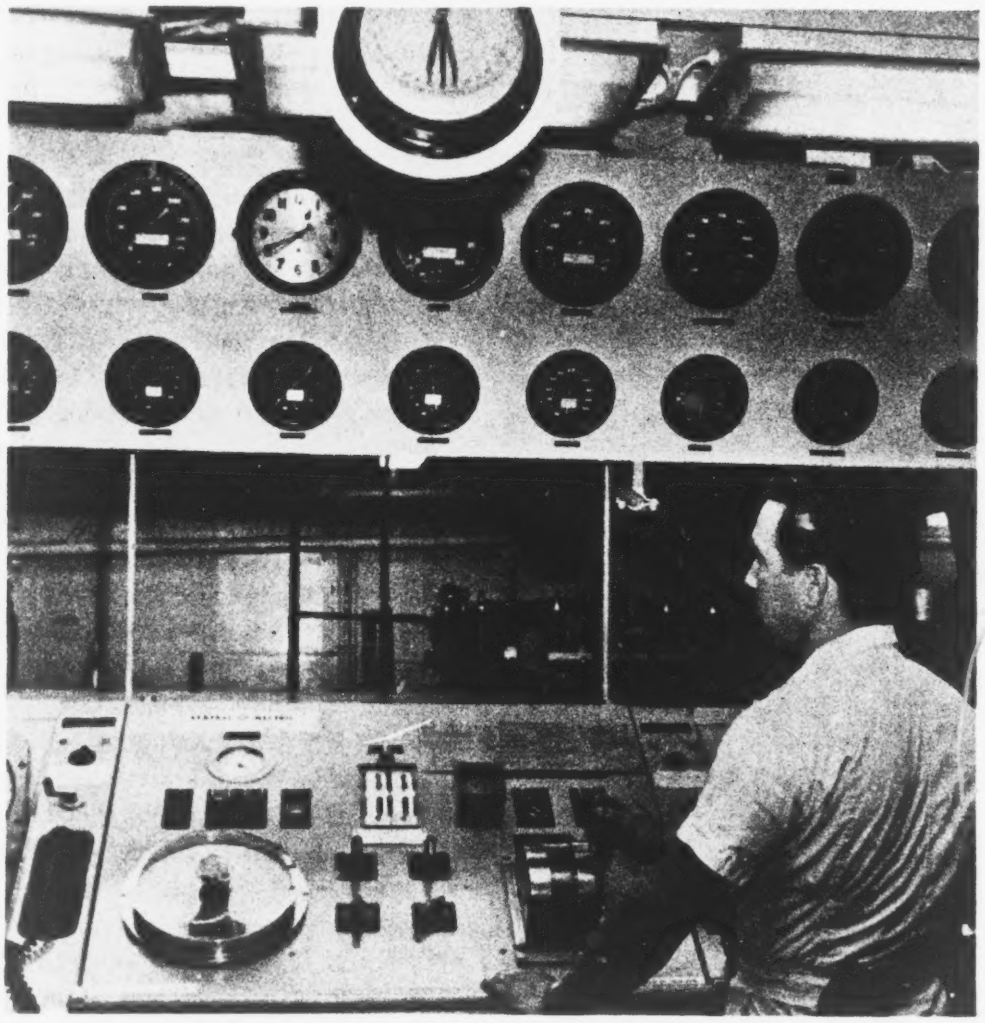
The *third mate* (D.O.T. 197.133), the most junior-rated deck officer, is responsible for the care and the maintenance of the navigating bridge and the chartroom. He acts as the signal officer and is in charge of all signaling equipment and assists in the supervision of cargo loading and unloading operations. Third mates frequently inspect life boats and other lifesaving equipment to be sure they are ready for use in fire, shipwreck, or other emergencies.

Engine Department. Marine engineers operate and maintain all engines and machinery aboard the ship. The *chief engineer* (D.O.T. 197.130) supervises the engine department, and is responsible for the operating efficiency of engines and other mechanical equipment. He oversees the operation of the main power plant and auxiliary equipment while the vessel is underway and is responsible for the log of equipment performance and fuel consumption.

The *first assistant engineer* (D.O.T. 197.130) supervises engine room personnel and directs operations such as starting, stopping, and controlling the speed of the main engines. He oversees and inspects the lubrication of engines, pumps, electric motors, generators, and other machinery, and with the aid of the chief engineer, directs all types of repairs.

As with the deck department, the engineroom is operated on a 24-hour basis. Second and third assistant engineers are assigned watch periods during which they are responsible for the operation of the ship's propulsion plant and auxiliary machinery and the supervision of engine department personnel. Marine engineers on watch must notify the chief engineer of any unusual occurrence and keep a record of equipment performance.

Each member of the engineering staff performs specific duties. The *second assistant engineer* (D.O.T. 197.130) has charge of the boiler and associated equipment such as the water-feed system and pumps. He is responsible for the maintenance of proper steam pressure and



Marine engineer controls running speed of main engine.

oil and water temperatures. He supervises the cleaning of the boilers and is usually responsible for their operation and the operation of the steam generator.

The *third assistant engineer* (D.O.T. 197.130) supervises the operation and maintenance of the lubrication system and engineroom auxiliaries. At least one third assistant engineer is employed as a day man (nonwatchstander) and is responsible for the electrical and refrigeration systems aboard ship.

Other officers. A ship maintains contact with shore and other vessels through its *radio officer* (D.O.T. 193.282), who also maintains radio equipment. A passenger ship carries three to six radio officers; the average cargo vessel employs one. The officer sends and receives messages by voice or Morse code. He periodically receives and records time signals, weather reports, position reports, and other navigation and technical data. The radio officer may also maintain depth recording equipment and electronic navigation equipment.

Some cargo and tanker vessels and all passenger vessels carry *pursers* (D.O.T. 197.168). The purser or staff officer performs the extensive paperwork required to enter and clear a ship in each port, prepare payrolls, and assist passengers as required. In recent years, the Staff Officers Association has established a program to train pursers to act also as pharmacist mates. This instruction is designed to improve the medical care aboard freighters and tankers and facilitate Public Health clearance when a ship arrives in port. All passenger ships must carry licensed doctors and nurses.

Places of Employment

Nearly 11,000 officers were employed aboard U.S. Flag oceangoing vessels during mid-1970. Deck officers and engineering officers accounted for more than four-fifths of total employment, and radio officers made up most of the remainder.

About 70 percent of the officers were aboard dry cargo vessels and 27 percent were aboard tankers. The remaining 3 percent manned passenger vessels.

Training, Other Qualifications, and Advancement

Persons applying for the first time for an officer's license in the deck and engineering departments of oceangoing vessels must meet certain legal requirements. Captains, chief and second mates, and chief and first assistant engineers must be at least 21 years of age. The minimum age for third mates, third assistant engineers, and radio operators is 19. In addition, applicants must present documentary proof of U.S. citizenship and obtain a U.S. Public Health Service certificate attesting to their vision, color perception, and general physical condition.

In addition to legal and medical requirements, candidates for deck officer rating must pass Coast Guard examinations that require extensive knowledge of seamanship, navigation, cargo handling, and the operations of the deck department. Marine engineering officer candidates must demonstrate in-depth knowledge of propulsion systems, electricity, plumbing and steam fitting, metal shaping and assembly, and ship structure. To advance to higher ratings, officers must pass progressively more difficult examinations.

For a Coast Guard license as a radio officer, applicants must have a first or second-class radiotelegraph operator's license issued by the Federal Communications Commission. For a license to serve as the sole radio operator aboard a cargo vessel, the Coast Guard also requires 6 months of radio experience at sea.

Unlike most professions, no education requirements have been established for officers. A seaman who has served for 3 years in the deck or engine department may apply for either a third mate's license or for a third assistant engineer's license. However, because of the complex machinery, navigational, and electronic equipment on modern ships, formal training usually is needed to pass the Coast Guard's examination for these licenses.

The fastest and surest way to become a well-trained officer is through an established training program. Such programs are available at the U.S. Merchant Marine Academy at Kings Point, N.Y. and at five State merchant marine academies: California Maritime Academy, Vallejo, Calif.; Maine Maritime Academy, Castine, Maine; Massachusetts Maritime Academy, Hyannis, Mass.; Texas Maritime Academy, Galveston, Tex.; and New York Maritime College, Fort Schuyler, New York, N.Y. Approximately 600 students graduate each year from the six schools; about one-half are trained as deck officers and one-half as marine engineers. Entrance requirements for each of the academies are very high. Admission to the Federal academy is through nomination by a member of Congress, whereas entrance to the other academies is made through written application directly to the school.

Each of the academies offers 3- or 4-year courses in nautical science or marine engineering, as well as practical experience at sea. Subjects include navigation, mathematics, electronics, seamanship, propulsion systems, electrical engineering, languages, history, and shipping management. Each student receives a subsistence allowance and a bachelor of science degree upon graduation. After Coast Guard examinations are passed, licenses are issued for either third mate or third assistant engineer. In addition, graduates may receive commissions as ensigns in the U.S. Naval Reserve.

Because of their thorough grounding in theory and its practical application, academy graduates are in the best position to move up to master and chief engineer ratings. Their well-rounded education also helps qualify them for shoreside jobs such as marine superintendent, operating manager, or shipping executive.

A number of trade unions in the maritime industry provide officer training. These unions include the International Organization of Masters, Mates and Pilots; the Seafarers' International Union; the Brotherhood of Marine Officers; and the National Marine Engineers' Beneficial Association. Most union programs are designed to upgrade experienced seamen to officer ratings, although some programs accept inexperienced young men. For example, the National Marine Engineers' Beneficial Association (MEBA) operates the Calhoon MEBA Engineering School in Baltimore, Md., which offers high school graduates a 3-year apprenticeship training program in preparation for a third assistant engineer's license. The program consists of both classroom instruction and sea experience and provides free room, board, medical care, and text books in addition to a monthly grant. Trainees must agree to serve at least 3 years in the U.S. Merchant Marine after the 3-year training period.

Advancement for deck and engine officers is along well-defined lines and depends primarily upon specified sea experience, passing a Coast Guard examination, and leadership ability. Deck officers start as third mates. After 1 year's service they are eligible to take a second mate examination. A second mate may apply for a chief mate's license after 1 year of service, and a chief mate may apply for a captain's license after 1 year of service. An officer in the engine department starts as third assistant engineer. After 1 year of service, he may apply for a second assistant's license. After further experience, he may apply for first assistant's license and finally a chief engineer's license.

Whether an officer's best prospects lie in the deck or the engineering department is a question generating considerable debate among the unions representing these workers. It seems clear, however, that the present sharp craft line drawn between deck and engineering jobs will become blurred. The emphasis will be on job function; the newest automated equipment will cut across departmental lines, union jurisdictions, and present work specialties. Some jobs will be entirely new, and both officers and seamen will require a new inventory of skills to hold them. For example, experience gained by standing watch in an engineroom of a conventional vessel may be secondary compared with basic courses in electronics.

In anticipation of this trend, the U.S. Merchant Marine Academy now selects 10 percent of the approximately 300 men who enter the academy each year to be trained as "omnicompetent" officers. They are taught both navigational and technical skills so they can work in either department.

Employment Outlook

Employment of ship officers is expected to decline moderately during the 1970's. However, some jobs will arise each year from the need to replace experienced officers who retire, die, or take shoreside employment.

The primary factors responsible for the expected employment decline are the continued decrease in the size of the fleet and the smaller crews on new vessels which result from mechanization. Future employment requirements in the final analysis will depend upon government policy with respect to the level of U.S. flag participation in waterborne foreign commerce. (See introductory statement on Merchant Marine Occupations for additional information on employment outlook.)

Earnings and Working Conditions

Earnings of officers depend upon rank and the size and type of ship. Wages are highest on large ships. The accompanying tabulation shows monthly base wages for officers aboard an average freighter. Additional payments for overtime, supplemental pay and "penalty pay" generally average about 50 percent of base pay. A monthly sum in lieu of overtime is paid to captains, chief mates, chief engineers and first and third assistant engineers who do not stand watch. The officer's rank and the type of ship determine the monthly sum, which ranged from $218 to $700 in 1970.

	Base pay[1]
Captain	$2,305
First mate	1,271
Second mate	901
Third mate	809
Radio officer	996
Purser	[2] 743
Chief engineer	2,126
First assistant engineer	1,271
Second assistant engineer	901
Third assistant engineer	809

[1] East Coast wages in August 1970 aboard a 12,000–17,000 power ton single screw ship.

[2] Purser/pharmacist mate, $806.

Officers and their dependents enjoy substantial benefits from noncontributory pension and welfare plans. For example, deck officers are eligible for a monthly pension of $325 after 20 years of service, and up to one-half their monthly rate after 25 years of service. Men forced to retire prematurely due to a permanent disability receive partial pensions. Comprehensive medical care and hospitalization are provided for officers and their families through union programs.

Aboard ship, each officer has a private room with hot and cold running water, and his room is cleaned daily by a steward. Officers eat in a dining salon separate from the messhall in which seamen eat.

A number of labor organizations represent merchant marine officers. The two largest are the International Organization of Masters, Mates and Pilots representing deck officers and the National Marine Engineers' Beneficial Association representing engineering officers. Unions for Officers may require initiation fees as high as $1,000.

The Brotherhood of Marine Officers represents deck and engine officers on about 30 vessels. The Staff Officers Association represents pursers on all Atlantic and Gulf Coast passenger vessels and certain freighters. Radio officers are represented by the American Radio Association and the Radio Officers Union. In addition, a number of independent unions represent officers on tankers.

(See introductory statement on Merchant Marine Occupations for more information on earnings and working conditions.)

Sources of Additional Information

General information about jobs in the merchant marine may be obtained from:

Office of Maritime Manpower, Maritime Administration, U.S. Department of Commerce, Washington, D.C. 20235.

Information about job openings, qualifications for employment, wage scales and other particulars can be obtained from local maritime unions. If no seafaring union is listed in a local telephone directory, information may be obtained from the following:

International Organization of Masters, Mates and Pilots, 39 Broadway, New York, N.Y. 10006.

National Marine Engineers' Beneficial Association, 17 Battery Place, New York, N.Y. 10004.

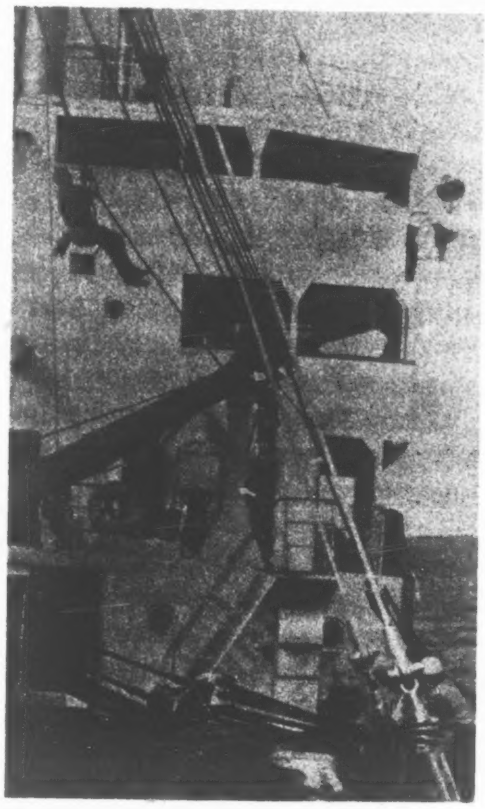
UNLICENSED MERCHANT SEAMEN

Nature of the Work

Unlicensed seamen make up most of a ship's crew and do most of the manual labor. Employment is along craft lines with varying skill levels and includes the following departments: Deck, engine, and steward's department.

DECK DEPARTMENT. Ordinary Seamen (D.O.T. 911.887), the entry rating in the deck department, scrub decks, coil and splice ropes, chip rust, paint, clean personnel quarters of the deck department, and do other general maintenance work. Ordinary seamen also may relieve the helmsman and lookout. All freighters and tankers customarily employ three ordinary seamen; each man is assigned a watch at sea.

Able Seamen (D.O.T. 911.884) constitute about one-fifth of the seamen. Dry cargo and tanker vessels usually have six able seamen, two of whom are assigned to each watch. These skilled workers must have a thorough knowledge of all parts of the ship and be able to handle all gear and deck equipment. They act as helmsmen or quartermasters to steer the ship. Usually, they each take 2-hour turns at the wheel, and as lookouts report sightings to the watch officer. Able seamen on passenger ships perform many of the same functions as those on freighters and tankers.



Able seamen are also responsible for rigging, overhauling, and stowing cargo-handling and other gear. They must be able to tie common knots and handle mooring lines when the ship is docking or departing. In addition to their more skilled tasks, they perform general deck maintenance work similar to that performed by ordinary seamen.

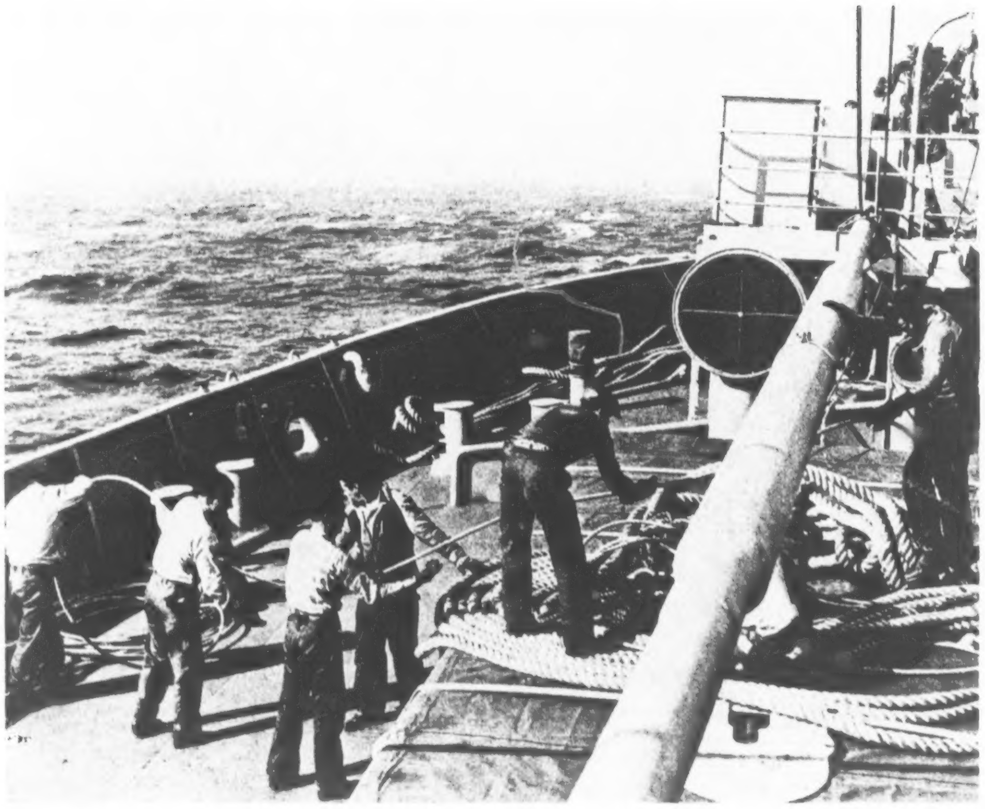
Because of the ever-present danger of fire at sea, able seamen must be familiar with approved methods of five prevention and control. They participate in periodic boat drills and are trained in all operations connected with launching lifeboats and life rafts, and handling of the boats and commanding boat crews.

The boatswain (D.O.T. 911.131), or bosun, is a day worker (nonwatchstander) and the highest ranking able seaman. As foreman in charge of the deck crew he relays the deck officers' orders and sees that such orders are carried out. The boatswain assists the chief mate in assigning work for crew members not on watch duty and directs general maintenance operations such as cleaning decks and polishing metalwork. When the ship docks or anchors, he supervises the deck crew in handling the lines used for mooring.

Most cargo vessels carry one to three *deck utilitymen* (D.O.T. 911.884), day workers who maintain the deck department under the direct supervision of the boatswain. Deck utilitymen must qualify as able seamen so that in emergencies they may stand watch. They determine the condition of bilges (compartments in the bottom of the hull), overhaul blocks, and do general maintenance work.

Some vessels carry a *ship's carpenter* (D.O.T. 860.281) who secures cargo hatches and ports, and braces (shores) cargo. He may operate winches that hoist and drop the anchor and seal the hawsepipes (steel pipes through which anchor chains pass) when anchor and chains are not in use. Because of mechanization, newer ships are sailing with fewer carpenters and deck utilitymen.

ENGINE DEPARTMENT. The engineering staff consists of a variety of occupational specialties requiring varying degrees of skill from the entry rating of wiper to specialized skilled jobs such as reefer engineer. *Wipers* (D.O.T. 699.887) are day workers who keep the engine room and machinery clean. Most cargo vessels carry two or three wipers. *Oilers* (D.O.T. 911.884) lubricate moving parts or wearing surfaces of mechanical equipment. They make regular rounds of ship machinery to check oil pressures and flow. They inspect the machinery for overheating, fuel supply, and apply proper grades of grease or oil to all machinery. Oilers may help overhaul and repair main and auxiliary engines. *Firemen/watertenders* (D.O.T. 951. 885) check and regulate the amount of water in the boilers; inspect gauges; regulate fuel oil gauges to keep steam pressure constant; and change and clean burner nozzles. They also check the operation of evaporators and con-



densers and test water for salt control; clean oil burning equipment; remove, clean, and replace burners; and clean strainers used to filter dirt from oil.

The *ship's electrician* (D.O.T. 825.281) takes orders from the chief engineer. He repairs and maintains electrical equipment, such as generators and motors. He tests wiring for short circuits and removes and replaces fuses and defective lights. Many vessels carry a *second electrician* to help maintain and repair electricial equipment and machinery.

All automated vessels carry *deck-engine mechanics* of whom one usually is classified as a day worker and three as watchstanders. Mechanics replace the oilers and firemen-watertenders on conventional vessels. Certain types of ships require men who have special skills, such as *refrigeration engineers* (D.O.T. 950.782) who operate refrigerator compartments for perishable cargoes such as meat and vegetables.

STEWARD'S DEPARTMENT. The *chief steward* (D.O.T. 350.138) supervises the operation and maintenance of the living quarters of officers, crew, and passengers. He directs and supervises all the department's personnel, orders and purchases food supplies, inspects and stores supplies, and supervises the preparation and serving of meals and the care and upkeep of living quarters. The *chief cook* (D.O.T. 315.131) and assistant cooks prepare meals. The chief cook helps the steward plan meals and draw pantry supplies from the storeroom. He also supervises the other galley (ship's kitchen) workers and is responsible for keeping the galley clean and orderly. The chief cook may be assisted by a *cook baker* (D.O.T. 315.381). *Utilitymen* (D.O.T. 318.887) and *messmen* (D.O.T. 350.878) complete the crew in the steward's department. These beginning jobs require little skill. Generally, utilitymen carry food supplies from the storeroom and iceboxes; prepare vegetables; wash cooking utensils and scour galley equipment. Messmen set tables, serve meals, clean tables, wash dishes, and care for living quarters.

Places of Employment

Seamen employed aboard U.S. oceangoing vessels numbered about 31,000 in mid-1970. Skilled deck and engine seamen made up about one-half of the work force and skilled personnel in the steward's department, one-sixth. The steward's department employs the greatest concentration of unskilled workers, about one-fifth of total seamen.

About 65 percent of the seamen were aboard dry cargo ships, and about 28 percent were aboard tankers. The remaining 7 percent manned passenger ships.

Training, Other Qualifications, and Advancement

Although not required, previous sea experience in the Coast Guard or Navy provides a good background for entering the merchant marine. Applicants must possess health certificates. In addition, every person going to sea for the first time must obtain seaman's papers from the U.S. Coast Guard. Seaman's papers, however, do not guarantee a job. They merely qualify a person to be considered for a job when the supply of regular workers has been exhausted. To get a job, a man must be present at the hiring hall when the opening becomes available. In good shipping times an opening may come within a few days or weeks; in less prosperous times an opening may never appear.

An inexperienced man usually gets a job by applying for work at a central hiring hall in one of the chief ports of the country. These hiring halls are operated by unions for commercial vessels and by the Navy's Military Sealift Command (MSC) for government operated ships. In most ports along the Atlantic and Gulf Coasts and Great Lakes, the National Maritime Union or Seafarers' International Union operate hiring halls. The Sailors Union of the Pacific operates hiring halls in many ports of the West Coast. MSTS employment offices are located at Brooklyn, N.Y.; New Orleans, La.; and Oakland, Calif.

The jobseeker is given a shipping card when he registers at the hiring hall. The shipping companies send job orders to the hiring hall and the applicant unemployed the longest is entitled to the first preference on a job for which he is qualified. The applicant must be present at the hall when the job is announced and he may lose his place if he is not present, or has turned down three job offers.

A seaman advances in the deck and engine departments by serving a designated period in a rating and by successfully completing a Coast Guard examination which tests the seaman's ability to use and maintain the equipment in his department. For example, after serving a minimum of 1 year, the ordinary seaman may apply to the Coast Guard for limited endorsement as an able seaman. For full endorsement, the applicant must be 19 years of age and pass an examination to test his knowledge of seamanship and ability to carry out all the duties required of an able seaman. Seamen who have the ability to supervise may advance to boatswain after years of service.

Advancement to higher positions in the steward's department is by recommendation of the chief steward to the captain. A messman or utilityman can advance to third cook, to cook/baker, to chief cook, and finally to chief steward.

Most training programs in the industry are designed to help experienced men upgrade their ratings. However, the Seafarers' International Union of North America operates the Harry Lundeberg School for seamanship at Piney Point, Md. that accepts and trains in general seamanship skills a limited number of young men who have no previous sea experience. Upgrading courses for seamen are offered by the Seafarers' Union; the National Maritime Union of America, and a number of other organizations.

Employment Outlook

Workers seeking employment as seamen will face keen competition during the 1970's as the total number of ships declines and crews are reduced. The total number of seamen is expected to decline moderately. Demand for men in entry ratings will be especially limited. However, some jobs will arise each year from the need to replace experienced seamen who retire, die, or quit the sea for other reasons.

Many of the merchant vessels now operating in the U.S. fleet are of World War II vintage and are approaching obsolescence. New ships and refitted ships are equipped with mechanized features which limit manpower requirements, particularly in the unskilled ranks. (See introductory statement on Merchant Marine Occupations for additional information on employment outlook.)

Earnings and Working Conditions

Crew members of American merchant ships enjoy excellent pay and fringe benefits. Most jobs provide 60 days' paid vacation each year, some even longer. Earnings depend on job assignments and type of vessel. Basic monthly pay for a cross section of ratings on a typical freighter is illustrated in the accompanying tabulation:

	Base pay[1]
Able seaman	$499
Ordinary seaman	389
Deck utilityman	557
Carpenter	603
Electrician	771
Oiler	499
Fireman/watertender	499
Wiper	463
Chief steward	655
Cook/baker	567
Messman/utilityman	306

[1] East Coast wages in August 1970 aboard a 12,000–17,000 power ton single screw ship.

Monthly earnings are supplemented by premium pay for overtime and other factors. On the average, premium earnings are equal to about 50 percent of base wages. For example, an oiler with a monthly base pay of $499 may regularly earn about $750 each month.

A person working in the engine room must be able to withstand high temperatures. A deckworker must adapt to both the bitter cold and hot sun.

Accommodations for seamen aboard U.S. merchant vessels are generally good, but not luxurious. Meals are served in a mess hall, which often doubles as a recreation room where the crew can read, write letters, play cards, and socialize. Crewmen generally share quarters aboard older ships and have little privacy, but most new ships have single rooms.

Seamen are represented by a number of labor organizations; the two largest are the National Maritime Union of America and the Seafarers' International Union of North America.

(See introductory statement on Merchant Marine Occupations for more information on earnings and working conditions.)

Sources of Additional Information

General information about jobs in the merchant marine may be obtained from:

Office of Maritime Manpower, Maritime Administration, U.S. Department of Commerce, Washington, D.C. 20235.

Information about job openings, qualifications for employment, wage scales and other particulars can be obtained from local maritime unions. If no seafaring union is listed in a local telephone directory, information may be obtained from:

National Maritime Union of America, 36 Seventh Avenue, New York, N.Y. 10011.

Seafarers' International Union of North America, 675 Fourth Avenue, Brooklyn, N.Y. 11232.

RADIO AND TELEVISION BROADCASTING OCCUPATIONS

The glamor and excitement associated with radio and television make careers in broadcasting attractive to many young people. The electronic technology involved in transmitting programs and the business aspects of operating a broadcasting station or network also are attractions. In 1970, 112,000 full-time and 26,000 part-time staff were employed in broadcasting; altogether, approximately 60 percent were employed in radio. Staff employees work for a broadcasting station or network on a regularly scheduled and continuous basis. In addition to staff employees, several thousand freelance performers, such as actors, musicians, dancers, comedians and top-level announcers work on specific assignments from stations, networks, and other program producers. (Several thousand other employees work for independent program producers in activities closely related to broadcasting, such as the preparation of filmed and taped programs and commercials for broadcasting.)

Women make up almost a fourth of broadcasting staff employment. They frequently work as production assistants, producers, newswriters, continuity writers, casting directors, and costume or set designers. They also work in the many office occupations often filled by women. A job as secretary is frequently a good entry job for women interested in the programing and administrative areas of broadcasting.

Broadcasting stations offer a variety of interesting jobs in all parts of the country. Opportunities for entry jobs are best at stations in small communities. Generally, the most specialized and best paying jobs are in large cities, especially those with national network stations. Nevertheless, the talented individual will have many opportunities to advance to good paying jobs in stations located in smaller communities.

Nature and Location of the Industry

In 1970 about 6,400 commercial radio stations were in operation in the United States. Of these, approximately 4,300 were AM stations; and approximately 2,100 were FM stations. During this same period, about 690 commercial television stations were in operation.

Most commercial radio broadcasting stations are small, independent businesses. In 1969, the average commercial radio station had about 11 full-time employees and 3 part-time workers. Television stations were generally larger, and on the average, they employed about 60 full-time and 7 part-time employees.

Commercial radio stations are served by seven nationwide networks and a large number of regional networks. Stations can affiliate with networks by agreeing to broadcast their programs on a regular basis. National radio networks have affiliated stations in almost every large metropolitan area, although only a minority of all radio stations are affiliated with national networks. Regional radio networks have fewer affiliated stations, and their activities usually consist of arranging for the sale of advertising time, and interconnecting member stations for special events such as baseball and football games. Regional networks have few full-time employees because their programing is conducted by staff employees of the affiliated stations. The seven national radio networks, together, employed approximately 1,150 workers in 1969.

Most television stations depend on one of the three national television networks for programs that would be too expensive for individual stations to originate—for example, sports events such as world series baseball games, or newscasts of national and international significance. These networks, in turn, can offer national coverage to sponsors. Since some small cities have only one or two television stations, these stations often carry the programs of two or three networks to offer their viewers a wider variety of programs. A typical network television show may be carried by up to 200 stations across the country. In 1969 the three national television networks employed about 13,000 workers, or 3 of every 10 staff employees in television. Practically all large broadcasting stations are located in metropolitan areas. About one out of four broadcasting jobs are in New York and California because New York City and Los Angeles are the two major centers for origination of network programs. In addition, one out of three broadcasting jobs are in Texas, Pennsylvania, Illinois, Ohio, Florida, Michigan, North Carolina, Tennessee, Georgia, and Indiana. The balance of broadcasting jobs are distributed throughout the other States.

In addition to commercial broadcasting stations, there were over 400 noncommercial radio stations (mainly FM), and approximately 190 noncommercial television stations, both VHF and UHF, in 1970. These stations are operated by non-profit organizations, principally educational agencies such as State commissions; local boards of education; colleges and universities; and special community educational television organizations. According to a private survey for fiscal '69, these stations employed approximately 5,500 full-time and 2,600 part-time workers accounting for about one out of 20 in broadcasting.

Broadcasting Occupations

Employees of broadcasting stations generally specialize in one of the following four major areas: preparing and producing programs; operating and maintaining electronic equipment (for transmitting sounds and pictures to home receivers); selling broadcast time and developing publicity and promotional material; and handling general business matters (including accounting, payroll, public relations, personnel administration, and the clerical work).

Nearly half of all staff employees in broadcasting hold professional and technical jobs such as staff announcer, newsman, continuity writer, or broadcast technician. About one-fourth hold managerial jobs such as producer, manager, or director. Clerical workers accounted for about one of every seven workers, and sales workers for only slightly more than one of every 20 jobs in broadcasting. Of the remaining workers in broadcasting, skilled mechanics, such as radio and television repairmen, and skilled maintenance personnel, such as carpenters and electricians, were the largest groups of workers employed.

Job duties vary greatly between small and large stations. In small radio stations, a large proportion of broadcast time consists of recorded music and weather and news announcements. In small stations, the station manager, who frequently is also the owner, may act as business and sales manager, or perhaps as program director, announcer, and copywriter. Announcers in small stations may do their own writing, often operate the studio control board, and may even act as salesmen. The engineering staff may consist of only one full-time broadcast technician assisted by workers from the other departments. Small low-powered stations, which do not use a directional antenna, may employ a chief engineer part-time and share his services with similar stations in the community. In large radio and television stations, jobs are more specialized and usually are confined to one of the four departments. The kinds of jobs found in each of these departments are described below.

Programing Department. Staff employees produce the daily and weekly shows, assign personnel to cover special events, and provide general program services such as sound effects and lighting. In addition to these staff employees, freelance actors, comedians, singers, dancers, some well-known announcers, and other entertainers are hired for specific broadcasts or a series of broadcasts or for special assignments. These performers work on a contract basis for the station, network, advertising agency, sponsor, or an independent company and specialize in producing programs.

The size of a station's programing department depends on the extent to which its broadcasts are live, recorded, or received from a network. In small stations, the program functions are handled by a few people who make commercial announcements, read news and sports summaries, select and play recordings, and introduce network programs. A large television station, on the other hand, may have a program staff consisting of a large number of peo-

Program director in control room directs shooting of show.

ple in a wide variety of specialized jobs.

Responsibility for the overall program schedule of a large station rests with a *program director*. He arranges for a combination of programs that he believes will be most effective in meeting the needs of advertisers who buy the station's services and will at the same time be most attractive and interesting to members of the community served by the station.

Daily schedules of programs are prepared by a *traffic manager,* who also keeps a record of broadcasting time available for advertising. A *continuity director* is responsible for the writing and editing of all scripts. He may be assisted by a *continuity writer,* who prepares *Announcers' Books* ("copy"). These books contain the script and commercials for each program along with their sequence and length.

Individual programs or series of programs are planned and supervised by a *director*. In large stations, he may work under the supervision of a *producer*, who assumes responsibility for selection of scripts, financial control, and other overall problems of production. Many times these functions are combined in the job of *producer-director*. The director's major functions include selecting appropriate artists and studio personnel, scheduling and conducting rehearsals, coordinating the efforts of all the people involved in the show to produce effective entertainment, and directing the on-the-air show. He may be assisted by an *associate director,* who takes over such tasks as working out detailed schedules and plans, arranging for distribution of scripts and changes in scripts to the cast, and assisting in directing the on-the-air show. Some stations employ *program assistants* to aid in carrying out the orders of the director and his assistants. The assistants help assemble and coordinate the various parts of the show. They arrange for obtaining props, makeup service, art work, and film slides. They assist in timing the on-the-air show, preparing cue cards from the scripts, and using them to cue the performers. *Education and public affairs directors* act as a link between the station and schools, churches, and civic and charitable institutions. They supervise and edit most noncommercial programs.

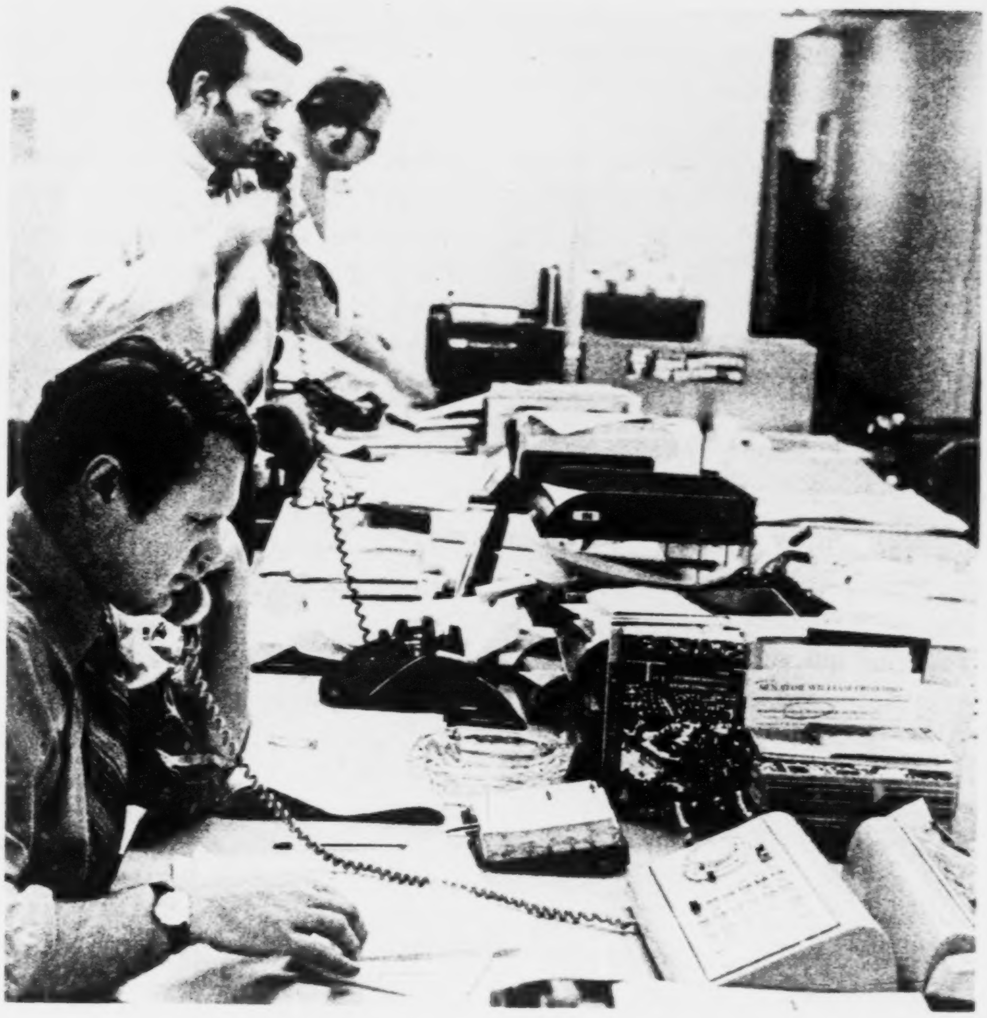
Announcers are the largest and best known group of program workers. In radio and television stations of all sizes, the announcer introduces programs, guests, and musical selections, and delivers most of the live commercial messages. (Further information on broadcast announcers is given later in this chapter.)

Music is an important part of radio programing. Both small and large stations use recordings and transcriptions to provide musical programs and background music for other shows. Large stations, which have extensive music libraries, sometimes employ a *music librarian,* who maintains the music files and answers requests for any particular selection or type of music. In addition to recorded music, a few of the largest stations have specialized personnel who plan and arrange for musical services. The *musical director* selects, arranges, and directs suitable music for programs on general instructions from the program director. He selects musicians for live broadcasts and directs them during rehearsals and broadcasts. Musicians are generally hired for particular assignments on a freelance basis, although a few stations employ staff musicians full-time.

News gathering and reporting is an increasingly important aspect of radio and television programing. In addition to daily coverage of the news, sports, weather, and, in rural areas, farm reports, the news department also presents special programs covering such events as conventions and disasters. The *news director* plans and supervises the overall news and special events coverage of a station. A *newscaster* broadcasts daily news programs and reports special news events on the scene. A *newswriter* selects and writes news copy to be read on the air by the newscasters. In small stations the jobs of newscaster and newswriter frequently are combined.

Stations that originate live television shows must have staff members capable of handling staging jobs. The *studio supervisor* plans and supervises the setting up of scenery and props. The *floor or stage manager* plans and directs the actors' positions and movements on the set in accordance with the director's instructions. The jobs of studio supervisor and floor manager often are combined. *Floormen* set up props, hold cue cards, and do the unskilled chores around the studio. (This job is frequently held by a beginner in the production department.) *Makeup artists* prepare personnel for broadcasts by applying proper makeup. *Scenic designers* plan and design settings and backgrounds for programs. They select furniture, draperies, pictures, and other properties to help convey the desired visual impressions. *Sound effects technicians* operate special equipment to simulate sounds, such as gunfire or falling water.

About half of all television programing is on film, about 15 percent is live, and the remainder is recorded on magnetic video tape. Video tape recording is done by



News writers revise information for clearance and editing.

broadcast technicians on electronic equipment that permits instantaneous playback of a television performance. It can be used either to record a live show being broadcast or to prerecord a program for future broadcast. For filmed programs, the role of the station's programing staff is limited to editing the film and timing and scheduling the show. Many stations employ specialized staff members to take care of filmed program material. The *film editor* edits and prepares all film for on-the-air presentation. This includes screening all films received as well as cutting and splicing feature films to insert commercials. He also edits all locally produced film. The *film librarian* catalogs and maintains the station's files of motion picture film.

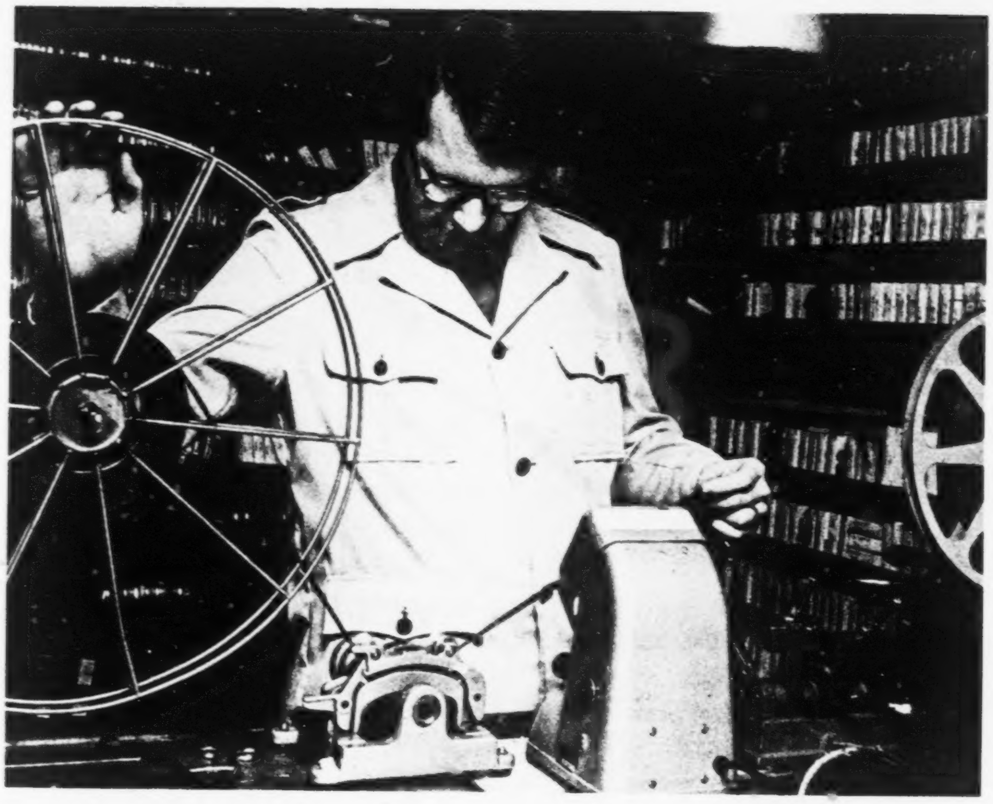
Engineering Department. The main tasks of the engineering staff are positioning microphones, adjusting levels of sound, keeping transmitters operating properly, moving and adjusting television cameras to produce clear, well-composed pictures, and lighting television scenes and performers. The staff also installs, maintains, and repairs the many types of electrical and electronic equipment required for these operations.

Broadcast technicians in the engineering department perform a variety of jobs in the radio or television station. For example, they control the operation of the transmitter to keep the output level and frequency of the outgoing broadcast within legal requirements. They also set up, operate, and maintain equipment in the studio and in locations from which remote broadcasts are to be made. (Further information on broadcast technicians is given later in this chapter.)

Most stations employ a *chief engineer*, who has responsibility for all engineering matters, including supervision of other technicians. In small stations, he also may work a regular shift at the control board. Large stations have engineers who specialize in fields such as sound recording, maintenance, and lighting. Networks employ a few *development engineers* to design and develop new electronic apparatus to meet special problems.

Sales Department. Time salesmen, the largest group of workers in this department, sell time on the air to sponsors, advertising agencies, and other buyers. They must have a thorough knowledge of the station's operations and the characteristics of the area it serves that are of most interest to advertisers. The latter include population, number of radio and television sets in use, income levels, and consumption patterns. Time salesmen in large stations often maintain close relationships with particular sponsors and advertising agencies by selling time and acting as general consultants and advisers in matters pertaining to advertising through the station. In very small stations, the time salesman also may handle other functions. Many stations sell a substantial part of their time, particularly to national advertisers, through independent sales agencies known as station representatives, which act as intermediaries for time buyers and stations or groups of stations.

Large stations generally have



several workers who do only sales work. The sales manager supervises his staff of time salesmen. He also may handle a few of the largest accounts personally. Some large stations employ statistical clerks and research personnel to assist the sales staff by analyzing and reporting market data relating to the community served.

Business Management. In a very small station, the owner and his secretary may handle all the recordkeeping, accounting, purchasing, hiring, and other more routine office work. Where the size of the station warrants the employment of full-time specialists, the business staff may include accountants, publicity specialists, personnel workers, and other professional workers. They are assisted by office workers such as stenographers, typists, bookkeepers, clerks, and messengers. Building maintenance men are employed to keep the facilities in good condition.

Training, Other Qualifications, and Advancement

A high school diploma is the minimum educational requirement for entry jobs in broadcasting, although for many jobs some college training is increasingly preferred. A liberal arts education is a good qualification for the beginner because broadcasting needs broadly educated people with knowledge and interests in many areas. Work in television programing for networks and large independent stations generally requires a college degree and some experience in the broadcasting field.

Training in specialized areas such as writing, public speaking, dramatics, designing, makeup, or electronics may be required of beginners in these specialties, even though work experience usually is not necessary. Some young people without specialized training or experience get their start in broadcasting in such jobs as clerk, typist, floorman, or assistant to an experienced worker. As these new workers gain knowledge and experience, they have the chance to advance to more responsible jobs. Young people are sometimes hired on the basis of their potentialities rather than for any specific training or experience, but the more skills, education, and varied background these beginners have, the better will be their chances for advancement. A few young people get started in broadcasting with temporary jobs in the summer when regular workers go on vacations, and broadcast schedules of daylight hours stations are increased.

Technical training in electronics is required for entry jobs in engineering departments. In addition, anyone who operates or adjusts a broadcast transmitter must have a Federal Communications Commission (FCC) Radiotelephone First Class Operator License. To obtain this license, an applicant must pass a series of technical examinations given by the FCC. Small radio stations with only a few employees sometimes prefer to have as many personnel as possible legally qualified to operate their transmitters. Because of this, nontechnicians, especially announcers, will have a better chance of getting a job in radio if they have a first class license. A course in electronics at a recognized technical institute is probably the best way to prepare for the FCC test.

Specific training or experience usually is not required for entry jobs as announcers in small stations, but an applicant must have a good voice, a broad cultural background, and other characteristics that make him a dramatic or attractive personality. Qualifications for adminstrative and sales jobs in broadcasting are similar to those required by other employers; a business course of study in high school or college is good preparation for such jobs.

Most beginners start out in small stations. Although these stations cannot pay high salaries, they offer new workers opportunities to learn many different phases of broadcasting work because they generally use their personnel in "combination" jobs. For example, in addition to his regular duties, an announcer may perform some of the duties of a broadcast technician.

People in the engineering department tend to remain in this area of work, where thorough training in electronics is essential. Program employees usually remain in programing work, although sometimes transfers from and to the sales and business services departments are made. Transfers are easier between sales and administrative departments because of their close working relationship; in fact, in the small stations, they are often merged into one department. Although transfers of experienced workers between departments are limited to the extent noted, these distinctions are less important in the beginning jobs and also in the top-level jobs. At the higher levels, a station executive may be drawn from top-level personnel of any department. Many top-level administrative jobs are filled by people with sales experience.

Employment Outlook

Employment in the broadcasting industry is expected to grow at a moderate pace for the balance of the 1970's. More job opportunities will result from replacement, as thousands of job openings become available as workers transfer to other fields of work, retire, or die. Retirements and deaths alone will provide an estimated 3,800 job openings annually.

New radio stations will be established over the period, primarily in small communities, and will offer opportunities for some additional workers. Also, cable television (CATV) has emerged as a powerful new force in communications and some additional job opportunities for professional, technical, and maintenance personnel will be created as CATV systems increasingly originate and transmit programs. By using coaxial cables instead of airwaves, CATV can bring to subscribers a large selection of over-the-air signals plus many additional programs originated for cable television.

The number of educational broadcasting stations is expected to increase as private and governmental groups continue to expand this medium as an educational tool. The growth of educational television stations, particularly, should increase the number of job opportunities, especially in programing, engineering, and station management.

In existing radio stations, employment probably will remain about the same. Continued introduction of equipment that permits the control of transmitters from the studio will eliminate the need for a technical crew at the transmitter site. Automatic programing equipment permits radio stations to provide virtually unattended programing service. As the smaller television stations acquire the capability to originate local color telecasts, there may be a small expansion in the number of technical workers to handle and operate the more complex equipment.

Competition will be very keen for entry jobs in broadcasting in the years ahead, especially in the large cities, because of the attraction this field has for young people, and the relatively few beginning jobs that will be available.

Earnings and Working Conditions

In 1970, earnings of nonsupervisory broadcasting workers averaged $147.45 a week or $3.86 an hour for an average 38.2-hour week. There is a wide range of salaries among various occupations in the industry and among locations. Employees in large cities generally earn much more than those in the same kinds of jobs in small towns. Wages also tend to be higher in large stations than in small ones and higher in television than in radio.

Working conditions in broadcasting stations are usually pleasant. The work is done in clean, attractive surroundings. It is performed indoors, except where remote pickups are involved. Jobs in programing are particularly attractive to young people interested in the performing arts, both because of the glamour attached to this field of work, and the opportunities it affords for high earnings and artistic expression.

Most full-time broadcasting employees have a scheduled 40-hour workweek. However, employees in many small stations have a longer workweek. Sales and business services employees generally work in the daytime hours common to most office jobs. However, program and engineering employees must work shifts which may include evenings, nights, weekends, and holidays. To meet a broadcast deadline, program and technical employees in the networks may have to work continuously for many hours under great pressure.

Many unions operate in the broadcasting field. They are most active in the network centers and large stations in metropolitan areas. The National Association of Broadcast Employees and Technicians and the International Brotherhood of Electrical Workers both organize all kinds of broadcasting workers, although most of their members are technicians. The International Alliance of Theatrical Stage Employees and Moving Picture Machine Operators organizes various crafts, such as stagehands, sound and lighting technicians, wardrobe attendants, makeup men, and cameramen. Many announcers and entertainers are members of the American Federation of Television and Radio Artists. The Directors Guild of America, Ind. (Inc.) organizes program directors, associate directors, and stage managers. The Screen Actors Guild Inc., represents the majority of talent personnel who appear on films made for television.

RADIO AND TELEVISION ANNOUNCERS

(D.O.T. 159.148)

Nature of the Work

Radio and television staff announcers present news and live commercial messages, introduce programs, describe sporting events, act as masters of ceremonies, conduct interviews, and identify stations. In small stations, they may perform additional duties such as operating the control board, selling time, and writing commercial and news copy. In large stations, their duties are confined to the programing department.

Many announcers act as disc jockeys, introducing selections of recorded music and commenting on the music and other matters of interest to the audience. Disc jockeys "ad-lib" much of the commentary, working without a detailed script.

About 17,000 staff announcers were employed on a regularly scheduled, full-time basis in radio and television broadcasting stations in 1970. More than 80 percent of them were employed in radio. The average radio station employed 2 announcers; larger stations employed 4 or more. Most television stations employed 2 staff announcers, although larger stations sometimes employed 3 or more. In addition to staff announcers, several thousand freelance announcers sell their services for individual assignments to networks and stations, or to advertising agencies and other independent producers, for both programs (news, sports, disc jockey, etc.) and commercials. Some announcers become well-known and highly paid personalities.

Training, Other Qualifications, and Advancement

To succeed as an announcer, one must have a pleasant and well-controlled voice, a good sense of timing, and excellent pronunciation. In addition, a thorough knowledge of correct English usage and a knowledge of dramatics, sports, music, and current events improve chances for success. In television, rather high standards of personal appearance also must be met. When on the air, an announcer must be able to react quickly and imaginatively in unusual situations. He also must be a convincing salesman when presenting commercials. In addition to all the above qualifications, the most successful announcers have a combination of personality and showmanship that makes them attractive to audiences. Therefore, anyone considering a career as an announcer should judge his chances of success realistically. Most announcers are men, but there are a few opportunities for women.

High school courses in English, public speaking, dramatics, and foreign languages, plus sports and music hobbies, are valuable background for prospective announcers. A number of vocational schools offer training in announcing, and some universities offer courses of study in the broadcasting field. A college liberal arts education also provides an excellent background for an announcer.

Most announcers get their first broadcasting jobs in small stations. Because announcers in small stations sometimes operate transmitters, prospective announcers often obtain an FCC Radiotelephone First Class Operator License which enables them legally to operate a transmitter and, therefore, makes them much more useful to these stations. Announcers more frequently operate control boards, for which only a Third Class license is required. (For information on how to obtain such licenses, see p. 756.)

Announcers usually work in several different stations in the course of their careers. After acquiring experience at a station in a small community, an ambitious and talented announcer may move to a better paying job in a larger community. He also may advance by getting a regular program as a disc jockey, sportscaster, or other specialist. In the national networks, competition for announcing jobs is intense, and an announcer usually must be a college graduate and have several years of successful announcing experience before he will be given an audition.

Employment Outlook

The employment of announcers is expected to increase moderately in the 1970's, as new radio and television stations are licensed. The gains in employment resulting from these openings during this period, however, will be reduced slightly by the increased use of automatic programing. Some job openings in this relatively small occupation will also result from transfers to other fields of work and from retirements and deaths.

It will be easier to get an entry job in radio than in television because of the greater number of radio stations, especially small stations which hire beginners. However, the great attraction this field has for young people and its relatively small size will result in keen competition for entry jobs.

Earnings and Working Conditions

Earnings of staff announcers vary and depend upon whether the announcer works in radio or television, in a large or small station, or in a large or small community. As a general rule, wages increase with the size of the community and the station. Earnings of an announcer in television tend to be somewhat higher than those in radio.

The earnings of many better paid announcers include fees in addition to the salaries received from stations. Such fees are larger and more common in television than in radio. In small radio stations, announcers generally are paid a fixed weekly or monthly salary. Announcers who work in regular shows, such as disc jockeys or announcers who become identified with popular network radio or television programs, earn considerably more than other staff announcers.

Most announcers in large stations work a 40-hour week and receive overtime for work beyond 40 hours. In small stations, many announcers work 2 to 8 hours of overtime each week. Evening, night, and weekend work occurs frequently since many stations are on the air 24 hours a day, 7 days a week. Announcers' working hours consist of both time on the air and time spent in preparing for broadcasts. Working conditions are usually pleasant because of the variety of work and the many personal contacts which are part of the job. Announcers also receive some satisfaction from becoming well known in the area their station serves.

BROADCAST TECHNICIANS

(D.O.T. 194.281, .282, and .782;
957.282; and 963.168 through .887)

Nature of the Work

Broadcast technicians set up, operate, and maintain the electronic equipment used to record or transmit radio and television programs. They work with microphones, sound recorders, lighting and sound effects devices, television cameras, magnetic video tape recorders, and motion picture projection equipment. In the control room, broadcast technicians operate equipment that regulates the quality of sounds and pictures being recorded or

Broadcast technician controls quality of transmission.

broadcast. They also operate controls that switch broadcasts from one camera or studio to another, from film to live programing, or from network to local programs. By means of hand signals and, in television, by use of telephone headsets, they give technical directions to personnel in the studio. When working on disc jockey programs, they sometimes operate phonograph record turntables. Other control room duties may include operating movie projectors, making recordings of live shows, and keeping an operation log of all broadcasts.

As a rule, broadcast technicians in small stations perform a wide variety of duties. In large stations and in networks, technicians are more specialized, although specific job assignments may change from day to day. Broadcast technicians who specialize may be given titles such as *transmitter technician* (monitors and logs outgoing signals and is responsible for proper operation of the transmitter), *maintenance technician* (sets up, maintains, and repairs electronic broadcasting equipment), *audio control technician* (operates controls that regulate sound pickup, transmission, and switching), *video control technician* (operates controls that regulate the quality, brightness, and contrast of television pictures), *lighting technician* (directs lighting of television programs), *field technician* (sets up and operates broadcasting equipment for programs originating outside the studio), *recording technician* (operates and maintains sound recording equipment), and *video tape recording technician* (operates and maintains magnetic video tape recording equipment). Sometimes the term "engineer" is substituted for technician in the above titles.

Installing and maintaining complex electronic equipment is the most technically difficult work of broadcast technicians. Most technicians do at least occasional maintenance, but large stations usually have one or two experienced men who repair and maintain electronic equipment under supervision of the chief engineer. In small radio stations, the chief engineer frequently does all maintenance and repair work himself.

When events taking place outside the studios are to be broadcast, technicians go to the site of the pickup and set up, test, and operate the necessary equipment. They also make emergency repairs. After the broadcast, they dismantle the equipment and return to the station.

In 1970, over 22,000 nonsupervisory broadcast technicians were employed in radio and television stations. Most radio stations employ fewer than four technicians, although a few large radio stations may employ more than 10. Nearly all television stations employ at least five broadcast technicians. Stations located in large metropolitan areas average about 30 technicians. Many broadcast technicians work in communities of more than 250,000 population. The highest paying and most specialized jobs are concentrated in New York, Los Angeles, and Washington, D.C.—the originating centers for most of the network programs.

In addition to the nonsupervisory technicians, several thousand supervisory personnel with job titles such as chief engineer, assistant chief engineer, director of engineering, technical director, and supervisory technician work in engineering departments. These workers supervise personnel who operate, maintain, and repair all electronic equipment in the studio, at the transmitter, and on remote broadcasting sites. They may also do maintenance and repair work, design and build new equipment, purchase equipment for the station, and help lay out plans for building new studios, transmitters, relay equipment, and towers.

Training, Other Qualifications, and Advancement

A young man interested in becoming a broadcast technician should plan to get a Radiotelephone First Class Operator License from the FCC. Federal law requires that anyone who operates or adjusts broadcast transmitters in television and radio stations must hold such a license. Some stations require all their broadcast technicians, including those who do not operate transmitters, to have this license. Applicants for the license must pass a series of written examinations covering the construction and operation of transmission and receiving equipment, the characteristics of electromagnetic waves, and Federal Government and international regulations and practices governing broadcasting. Information about these examinations and guides to study for them may be obtained from the FCC, Washington, D.C. 20036.

High school courses in algebra and trigonometry, and in physics and other sciences, provide valuable background for young men anticipating careers in this occupation. Building and operating an amateur radio station is also good training. A good way to acquire the knowledge necessary for becoming a broadcast technician is to take an electronics course in a technical school. Many schools give courses especially designed to prepare the student for the FCC first-class license test. Training at the technical school or college level is a distinct advantage for those who hope to advance to supervisory positions or to the more specialized jobs in large stations and in the networks.

Young men with FCC first-class licenses who get entry jobs are instructed and advised by the chief engineer or other experienced technicians concerning the work procedures of the station. In small stations, they may start by operating the transmitter and handling other technical duties after a brief instruction period. As they acquire more experience and skill, they are assigned to more responsible jobs. Men who demonstrate above-average ability may move into the top-level technical positions, such as supervisory technician and chief engineer. A college degree in engineering is becoming increasingly important for advancement to supervisory positions.

Employment Outlook

The number of broadcast technicians is expected to increase only slightly during the 1970's. Retirements, deaths, and transfers to other jobs will result in some additional job openings.

Some job opportunities for technicians will be provided by the new radio and television stations expected to go on the air during this period. In addition, color television broadcasting may slightly increase the need for technicians. Color television pickup and transmitting equipment is much more complicated than black and white equipment and requires more maintenance and technical know-how. However, other technical advances, such as automatic switching and programing, automatic operation logging, and remote control of transmitters will limit the increase in job opportunities in the new stations and replacement needs in existing stations.

Earnings and Working Conditions

Earnings of broadcast technicians vary greatly depending on such factors as the size and location of the community a station serves, the size of the station, whether he works in a radio or television station, and the experience of the individual. As a rule, technicians' wages are highest in large cities and in large stations. Technicians employed by television stations usually are paid more than those working for radio stations because television equipment is generally more complex.

Most technicians in large stations work a 40-hour week with overtime pay for work beyond 40 hours. Many broadcast technicians in the larger cities work a 37-hour week. In small stations, many technicians work 2 to 8 hours of overtime each week. Evening, night, and weekend work is frequently necessary since many stations are on the air as many as 24 hours a day, 7 days a week. Network technicians may occasionally have to work continuously for many hours and under great pressure in order to meet broadcast deadlines.

Broadcast technicians generally work indoors in pleasant surroundings. The work is interesting, and the duties are varied. When remote pickups are made, however, technicians may work out of doors at some distance from the studios, under less favorable conditions.

RAILROAD OCCUPATIONS

The railroads, with their network of more than 200,000 miles of rail line reaching into all parts of the country, are one of the Nation's largest employers. Over 500,000 railroad workers were employed in 1970, operating trains, maintaining and repairing facilities and equipment, and performing hundreds of other activities. These involve jobs requiring different kinds of skills and levels of education. In most railroad occupations, a worker starts at the bottom and works his way up by learning his job, proving his ability, and acquiring seniority.

Nature and Location of the Industry

The railroad industry is made up of "line-haul" railroad companies which transport freight and passengers between cities and towns, and switching and terminal companies which operate facilities at stations, at freight yards, and at other terminal points.

The Class I line-haul railroads, which include all the large, well-known companies, handle about 95 percent of the railroad industry's business and employ about 92 percent of all railroad workers. Equipped with nearly 27,000 locomotive units, about 12,800 passenger cars, and about 1.4 million freight cars, they transported more than 1.4 billion tons of freight and nearly 300 million passengers in 1970. Employment and Earnings data used in this chapter are for jobs on Class I line-haul railroad industry.

Of the various transportation services provided by the railroads, shipment of freight, in terms of commodities—like coal, ore, grain, lumber, and manufactured products—account for most railroad revenue and employment. Passenger service, though important, has declined substantially during the past 25 years. As a result, most job openings in the near future are likely to be related to railroad freight, rather than passenger, service.

Railroad workers are employed in every State except Hawaii and in both large and small communities, but the greatest number work at terminal points where the railroads maintain their central offices, freight yards, and maintenance and repair shops. The metropolitan area of Chicago, where the great eastern and western railroad systems meet, is the hub of the Nation's railroad network and has more railroad workers than any other area. Other places where particularly large numbers of railroad workers are employed are areas around New York City, Los Angeles, Pittsburgh, Philadelphia, Cleveland, and St. Louis.

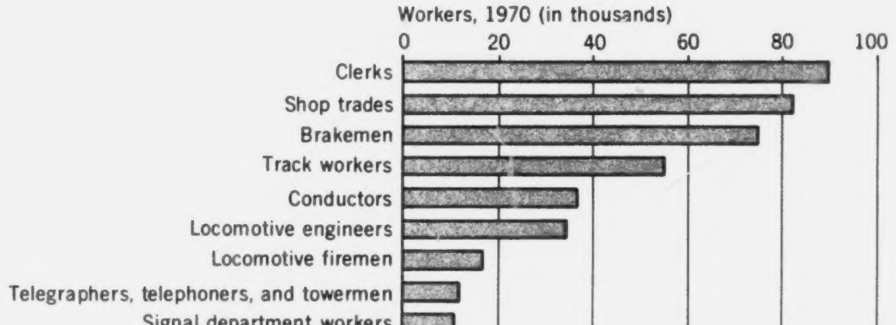
Railroad Occupations

The work force of the railroad industry can be divided into five main groups—employees who (1) operate trains, (2) handle communications, station, and office work, (3) build and maintain locomotives, cars, and other rolling stock, (4) build and maintain tracks, structures, and other railroad property, and (5) handle luggage, prepare and serve food, and provide other personal services to passengers. In 1970, 94 percent of the workers in railroad jobs were men. Most women employed by the railroads work in offices.

Chart 34 shows the number of employees in some of the principal railroad occupations. Other occupations range from unskilled laundry and cleaning jobs to professional positions such as accountant, engineer, and statistician. (Information about some of these jobs is given elsewhere in the *Handbook*.)

The workers directly engaged in running the trains, known as "oper-

(33) **Employment in selected railroad occupations 1/**



1/ ESTIMATED

SOURCE: BUREAU OF LABOR STATISTICS

ating employees," represent more than one-fourth of all railroad workers. Class I line-haul railroads employed approximately 165,000 operating employees in 1970. Included are locomotive engineers, firemen, conductors, brakemen, and, on some passenger trains, baggagemen. These men work together as train crews, operating trains either out on the "run" or at the terminals and railroad yards. Here, in the yards, freight is loaded and unloaded, freight cars received and switched, and trains are broken up and put together. Others who work in the yards include switchtenders, who assist conductors (or foremen) and brakemen (or switchmen) by throwing the track switches. Hostlers fuel locomotives, check their operating condition, and deliver them to the engine crews.

Another one-fourth of all railroad workers consists of "communications, station, and office" employees who regulate train movements and handle the railroads' business affairs. In 1970, Class I line-haul railroads employed about 14,000 persons in these jobs.

Communications are handled by dispatchers who coordinate the movement of trains and issue train orders. Then telegraphers, telephoners, and towermen either pass on these train orders—and other instructions—to the train crews or else execute them by setting signals and track switches. Agents are in charge of the railroad stations' business affairs. Railroad clerks work either in these stations or in company offices, doing secretarial and other kinds of office work, assisting station agents, dealing with customers, selling tickets, tending baggage rooms, keeping records, and performing related tasks. Also included in this "office, communication, and station" group of railroad workers are claims investigators, accountants, lawyers, motor vehicle operators, patrolmen, and watchmen.

More than one-fifth of all railroad workers are employed in railroad yards, carshops, and engine houses, houses maintaining and repairing locomotives, cars, and other railroad rolling stock. Class I line-haul roads employed about 124,000 workers in this group in 1970. Carmen perform a variety of repair and maintenance tasks necessary to keep railroad freight and passenger cars in good operating condition. Electrical workers, machinists, boilermakers, blacksmiths, and sheet metal workers, also are employed in carshops.

A considerably smaller group of railroad workers—about one-sixth of the total—maintains and constructs tracks, bridges, stations, signals, and other railroad property. The Class I line-haul railroads employed about 87,000 in work of this kind in 1970. Trackmen and other maintenance-of-way workers maintain, construct, and repair tracks and roadbeds. Bridge and building mechanics construct and maintain bridges, tunnels, and many other kinds of structures along the company's right-of-way. Signal workers install the railroad's vast network of train and crossing signals and maintain it in working order.

Another small group of railroad workers provides personal services to passengers at stations and aboard trains. With 5,600 employees in 1970, it is the smallest of the five major railroad occupational groups. Included in this group are porters and attendants who perform many kinds of personal service for passengers, as well as cooks and waiters who prepare and serve food. (Additional information about cooks and waiters is given elsewhere in the *Handbook.*)

Training, Other Qualifications, and Advancement

For most jobs, particularly those on the trains, in the yards, and around the stations, training is given on the job. The new employee usually learns by working and by receiving instructions from experienced men. For some office and maintenance jobs, training may be obtained in high schools and vocational schools. In addition, universities and technical schools offer courses in engineering, transportation, traffic management, and other subjects valuable to professional and technical workers.

New employees in some occupations—principally those connected with train or engine service—start as "extra board" men. That is, their names are placed on an "extra list" for individual occupations. From these lists, the workers are called to fill vacancies that arise from vacations, days off, or illnesses of men on regular jobs. They may be called for extra work because of an increase in railroad traffic, as well. When regular job assignments become available, extra board workers who have gained experience and seniority are assigned to regular positions. The time spent on extra board work varies with type of job and number of available openings. In some cases, workers may not receive regular assignments for a number of years, if regular openings do not develop as a result of decreased traffic, increased mechanization, and the like.

Apprenticeship programs are limited chiefly to trainees in the railroad shop crafts. Many of these programs are planned and operated jointly by the companies and the railroad workers' unions. Of the men who were taking this kind of training in 1970, the majority were "regular" apprentices (usually high school graduates with no previous work experience, who were working and receiving instruction in their chosen trades for a 4-year period). Others were "helper" apprentices, with some previous experience as railroad workers, who were receiving the same kind of training, usually for a 3-year period.

Applicants who have a high school education or its equivalent are preferred by railroad companies for most kinds of nonprofessional positions. Good physical condition is required for most jobs, and almost all large railroads require applicants to pass physical examinations before they are hired; in some jobs, physical examinations are required periodically. Excellent hearing and eyesight are essential for train and engine service jobs, and color blindness is an absolute bar to employment in work involving the interpretation of railroad signals.

Promotions of qualified workers to jobs covered by union-management agreements are made on the basis of seniority. Most job vacancies are listed on a bulletin board, and all workers interested may "bid" for them. The job goes to the qualified applicant whose length of service places him highest on the seniority list. Often, before workers can qualify for promotion, they must pass written and performance tests. For occupations in train and engine service, there are well-established avenues of promotion. Engineers usually are chosen from the ranks of the firemen, and conductors from the list of brakemen.

A railroad worker's seniority usually entitles him to promotion only for job openings which occur within a limited area or "seniority district" of the railroad system for which he works. In some cases, seniority rights may apply only to one shop, locality, or office. Among train and engine personnel, seniority rights may be limited either to road service or yard service. In such cases, workers may bid only for positions in the particular type of service in which they have been employed.

In addition to determining his right to advance, the worker's seniority also determines how much choice he has about working conditions. A beginning telegrapher, for instance, may have to work several years on a night shift in an out-of-the-way location until he accumulates enough seniority to get an assignment without these disadvantages.

(Later sections of this chapter contain more complete information about the training and other qualifications for selected occupations in the railroad industry.)

Employment Outlook

The longrun decline in railroad employment is expected to continue, but at a decreasing rate in the immediate years ahead. Technological innovation and changing patterns of transportation and production have resulted in a substantial decline in railroad employment in recent years. Developments such as the use of larger, more powerful diesel locomotives and extensive use of machines for roadway upkeep have had a considerable impact on railroad employment. The railroad work force has declined also as railroad passenger travel has dropped steeply and freight traffic has shown relatively little growth because of gains in competititve modes of transportation—notably automobiles, tracks, buses, airplanes, and pipelines.

Most of the factors which have led to reduced employment in the past are expected to continue to influence railroad employment during the decade ahead. In addition, mergers of connecting or parallel railroads could reduce railroad employment further by eliminating facilities such as those at terminals, and by combining accounting and other functions. Some mergers have occurred in recent years and, on the basis of present developments, others are likely.

Despite prospects of declining employment, job opportunities will be available annually for thousands of new railroad workers, as the railroads have one of the largest work forces in American industry. Since a high proportion are older workers, many jobs will become vacant because of retirements, deaths, promotions, and transfers to other fields of work. Since these jobs are filled within the ranks through seniority, they will leave some openings at entrance levels as incumbents are promoted.

Future job opportunities for applicants probably will be most numerous in construction and maintenance work along rights-of-way, in operating jobs for brakemen, and in office work. However, because of the seasonality of railroad construction and maintenance work, and a seniority system under which new workers are laid off first and recalled last, many new workers can expect to have less than full-time employment during the first few years on the job.

The number and type of job openings for applicants hired by an individual railroad will be influenced by the rapidity of the railroad's adoption of new equipment and new methods of operation, and its geographical location in relation to changing marketing conditions. An increased need may be felt for professional and technical personnel to handle new mechanical and electrical equipment, to find better means of utilizing equipment and personnel, to apply data processing to a wide range of accounting and statistical activities, and to explore new ways of meeting competition through industrial development and marketing.

Railroad freight traffic is expected to rise through the 1970's because of the high rate of growth anticipated in the economy. The shipment of highway trailers and large containers on railroad flat cars, and the use of larger, special-purpose freight cars should increase freight traffic significantly by improving rail carriers' ability to compete.

New interest also has been shown in the use of rapid rail transit for intercity and intra-urban passenger movement. Studies of the best methods for moving passengers within and between urban areas are progressing, and may result in a significant resurgence of rail passenger transportation.

Recently the Department of Transportation established Amtrak (National Railroad Passenger Corportation), a program to save and revive passenger service. Through Amtrak the government will give the industry the money and authority to reorganize the entire railroad system. It will take years to determine the effectiveness of this program, but it should result in retaining a national railroad passenger network.

Earnings and Working Conditions

Average earnings of railroad workers are higher than those of workers in most manufacturing industries. Employees of Class I line-haul railroads, exclusive of executive and administrative personnel, averaged $3.89 an hour or $171.94 a week in 1970, whereas production workers in all manufacturing industries averaged $3.60 an hour or $133.73 a week.

The earnings of individual railroad workers vary greatly because of the great variety of occupations and skill requirements. Geographic differences in wage levels are considerably less than in most other industries, since wage scales specified in many railroad labor-management contracts are identical throughout the country. (Earnings in some of the principal occupations are discussed in later sections of this chapter.)

Most railroad workers are trade union members, and many of the conditions under which they work are regulated by collective bargaining agreements, dealing with wage rates, hours, vacation pay, seniority, and other matters. (The principal unions representing each occupational group are listed in the sections of this chapter which deal with individual occupations.)

The work schedules of railroad employees and the conditions under which they are paid for overtime work depend upon the type of operation in which they are employed. The great majority of railroad employees work at terminals—in yards, stations, and railroad offices, where, in 1970, the "basic" workweek of most workers was a 5-day week of 40 hours. Premium pay, amounting to time and one-half the regular wage rate, usually was paid for any time worked over 8 hours a day.

In freight and passenger road service, the basic workday for train and engine crews is established differently. Generally, when a member of the train or engine crew has covered a specified number of miles, or has worked a certain number of hours—whichever occurs first—he receives a day's pay at his regular wage rate. He receives extra pay for any additional miles covered or hours worked on that day.

The basic hours of employees who serve the needs of passengers aboard trains—dining car cooks and waiters, Pullman porters, and train attendants—are set on a monthly basis. Some of these workers receive time and one-half pay for hours worked over 184 a month, and those employed on regular assignments are guaranteed at least 174 hours of work a month.

Because freight shippers and the traveling public must be served 24 hours a day, train and engine crews, hostlers, telegraphers and telephoners, and station agents must often work nights, weekends, and on holidays. Irregular work schedules are particularly common for extra board workers without regular assignments who may be called any time of the day or night. Other railroad workers, like bridge and building mechanics and certain track and road maintenance workers, are required to work away from home for days at a time.

Practically all railroad employees receive 1 week's paid vacation after 1 year on the payroll, 2 weeks after 3 years, 3 weeks after 10 years, and 4 weeks after 20 years. On most roads, employees receive pay for 8 holidays a year.

Under the federally administered Railroad Retirement Act of 1935, all employees having more than 10 years of service in the railroad industry receive pensions upon retirement. They receive full pensions when they reach age 65 and reduced pensions at age 62. Those who have worked for the railroads at least 30 years may retire on a reduced pension at age 60. Employees with 10 years service or more who become disabled and are unable to work, as well as dependent wives and husbands of railroad workers who have died, also receive pensions. In early 1970, the average pension paid to railroad workers who retired because of age and disability was about $192 a month.

Another Federal law, the Railroad Unemployment Insurance Act, provides benefits for railroad workers who become unemployed. Unemployment benefits are paid for a period up to 26 weeks, but workers having 10 years service or more can receive benefits for a longer period.

Under the Railroad Unemployment Insurance Act, railroad workers also receive compensation for workdays lost because of sickness or injury.

Other insurance programs are operated under agreements with trade unions and provide group life insurance to employees and comprehensive hospital and medical insurance to these employees and their dependents.

Sources of Additional Information

Additional information about occupations in the railroad industry can be obtained from railroad offices in your locality. General information about the railroad industry can be obtained from:

Association of American Railroads,
American Railroads Building, 1920
L St. NW., Washington, D.C.
20036.

LOCOMOTIVE ENGINEERS

(D.O.T. 910.383)

Nature of the Work

The engineer is responsible for running the locomotive safely and efficiently. He operates the throttle, air brakes, and other controls, and he supervises the work of the fireman (helper) who may work in the cab with him. Engineers work either in railroad yards or else on the road; in the latter case, in passenger or freight service.

The engineer in yard service operates the locomotive or switch-engine, used to move freight and passenger cars when trains are being put together before a run or broken up after one, or when cars are being switched for loading or unloading. The engineer in passenger or freight service operates the locomotive which moves trains over the road according to either train orders for each run or else any instructions received enroute.

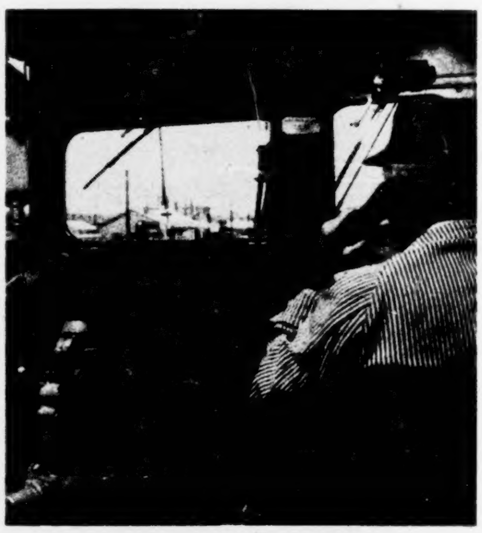
Before and after each run, the engineer checks on the condition of the locomotive. He then either has minor adjustments made on the spot or else reports to the engine foreman mechanical defects needing attention. While operating his locomotive, he must observe track signals and comply with speed restrictions at all hours and in all weather conditions. To do this he must be thoroughly familiar with the characteristics of the road over which he is operating. He must also be constantly alert, especially for obstructions on the track or other emergencies.

In 1970, about 35,000 engineers were employed by Class I line-haul railroads, and a few thousand more by short-line railways and switching and terminal companies.

Training, Other Qualifications, and Advancement

Vacancies in engineer positions generally have been filled by firemen (helpers) who have qualified for promotion. Selection is on a seniority basis. To qualify, the applicant must pass comprehensive examinations on the train's mechanical and electrical equipment, and on fuel economy, safety, timetables, train orders, and other operating rules and regulations. He also must be able to operate any kind of locomotive in service on his road.

Engineers are required to take physical examinations at regular intervals. They must have good eyesight and hearing. If they fail at any time to meet all the physical standards, they may be restricted to working as engineers only in certain types of service, or they may be transferred to other kinds of work where physical standards are less exacting.



Diesel engineer checks track conditions by radio.

Young people planning careers as locomotive engineers should have mechanical ability and good eye-hand coordination. They should be able to concentrate on detail in order to operate the complicated control system of a locomotive. The aspiring engineer must be capable of working in a confined area since the cab of the locomotive is small. Engineers should be willing to comply with irregular working hours.

The seniority system often requires the railroad employee to wait many years before he can move into the job he prefers. He must typically work some years as brakeman and fireman, in turn, first. Therefore, the person who wants to be engineer should be willing to work at other jobs until seniority entitles him to his chosen position.

A newly promoted engineer starts out as an extra board man without any regular assignment. It may be several years before he receives such an assignment. During this period, he works on temporary assignments whenever an engineer is needed. An experienced engineer may advance to a supervisory position, such as foreman of engines for his road.

Employment Outlook

Employment of locomotive engineers is expected to decline slowly during the 1970's. However, openings will arise from the need to fill positions left vacant by engineers who retire, die, or otherwise leave the occupation.

The number of engineers employed by the railroads has been declining for some years because of the decrease in railroad passenger business and because of multiple-unit operation of diesel locomotives. Introduction of technological innovations has also lowered employment levels. (These include the use of remote- and automatically-controlled devices for freight car classification and for signal control, as well as other changes in equipment and operating methods.)

The decline in the number of engineers may be somewhat slower in the 1970's if rapid transit rail systems are developed on a large scale.

Earnings and Working Conditions

The earnings of engineers depend on the class of locomotive operated and the kind of service in which the engineer is employed. In 1970, engineers in yard service for Class I line-haul railroads (including extra board men) earned, on the average, about $1,070 a month; in road freight service, $960 a month; in passenger service, $1,226 a month.

In 1968, the standard workweek at straight-time rates for yard engineers varied from 5 days on some railroads and railroad divisions to 7 days on others. All yard engineers worked basic 8-hour days with time and one-half paid for work over 8 hours. Under certain circumstances, they may be paid on an hourly basis or on a miles-hour basis.

On many roads, the amount a road engineer may earn in a single month is governed by mileage limitations agreed upon by the unions and the railroad companies. Whenever an engineer on one of these roads reaches this maximum number of miles, his assignment for the rest of the month is taken over by another engineer—usually an extra board man.

The engineer in road service, even on regular assignments, often is scheduled to work nights, weekends, and holidays at straight-time rates. Like other workers in road service, he must often "lay over" at the end of a run before he makes the return trip back to his home terminal.

The assignments of engineers on the extra board may be very irregular; these men may be called to work at any time of the day or night. Also, the amount of traffic varies from one season to another on many roads. Extra board engineers are likely to have less work and lower earnings than those men having regular assignments.

On all major railroads, wages and the conditions under which engineers work are agreed upon by employers and unions. The great majority of engineers are respresented by the Brotherhood of Locomotive Engineers (Ind.). Some are represented by the United Transportation Union.

LOCOMOTIVE FIREMEN (HELPERS)

(D.O.T. 910.383)

Nature of the Work

The locomotive fireman (helper) works with the engineer either in the railroad yards or in road service. At the beginning of his run, the fireman (helper) checks to make sure that the locomotive is supplied with the fuel, sand, and water needed, that the engine is in proper working order, and that the flagging equipment, classification markers, and tools needed by the engine crew are on hand and ready to use. During the run, he makes mechanical and electrical adjustments as needed. On passenger trains, he also is responsible for operating the equipment which supplies heat to the cars.

From his position at the left side

of the cab, the fireman (helper) assists the engineer by acting as lookout for obstructions on tracks and at road crossings, and by checking wayside signals which indicate the speed at which the train is to proceed. In addition, he inspects the train as it rounds curves because this view of the train enables him to spot smoke, sparks, fire, and other signs of defective equipment.

Class I line-haul railroads employed about 17,000 firemen in 1970.

Training, Other Qualifications, and Advancement

For the relatively few firemen (helper) positions being filled at present, most railroads prefer that applicants be 21 to 35 years of age. A high school education or its equivalent is desired. Good health is important, and firemen must be able to pass periodic physical examinations. Standards for eyesight and hearing are particularly high.

A beginning fireman first makes a series of trial trips in the railroad yard or on the road, working under the direction of an experienced engineer or fireman who instructs him about future duties and railroad rules and regulations. This training period lasts a few days on some roads and as long as 3 weeks on others. After the newly hired fireman has satisfactorily demonstrated his ability on the trial trips, and passed examinations on railroad rules and regulations, his name is placed on the firemen's extra board. He then becomes subject to call for temporary work assignments. He may remain on extra board work up to several years before he obtains his first regular assignment. On some roads, beginning assignments are in yard service, and the fireman advances first to road freight service and then to road passenger service. On other railroads, firemen usually remain either in yard service or in road service throughout their railroad careers.

Young people who want to be locomotive firemen should be able to follow instructions and they should be capable of being thorough and paying attention to detail. Major requirements of the job include good eye-hand coordination, manual dexterity, mechanical aptitude, above-average eyesight and color vision, quick reflexes, and general good health.

Firemen who have sufficient experience and seniority—usually at least 3 or 4 years—can become eligible for promotion to engineer by passing qualifying examinations covering the mechanical and electrical equipment on trains, air brake systems, fuel economy, timetables, train orders, and other operating rules and regulations. As engineers are needed, qualified firemen who have the longest seniority are placed on the engineers' extra board. Promotion to engineer, however, depends on availability of openings, as well as time spent on the extra board waiting for a regular assignment.

Employment Outlook

Job openings for work as locomotive firemen (helpers) have been extremely limited since May 1964, the effective date of a compulsory arbitration award designed to eliminate, eventually, all but a relatively few firemen (helper) positions in road freight and yard locomotive service. Fireman (helper) positions on locomotives in passenger service (which has been declining) were not affected by this award, nor were any positions of firemen (helpers) for any class of locomotive service operating where State law requires the employment of firemen on locomotives.

The national arbitration award expired in April 1966, and since no general agreement had been reached between the parties in the dispute by early 1971, the outlook for job opportunities in this occupation cannot be anticipated with any degree of certainty, although it appears that employment opportunities for new applicants will continue to be minimal.

Earnings and Working Conditions

The earnings of firemen depend on the class of locomotive on which they work and the type of service for which the locomotive is operated. Firemen in yard service for Class I line-haul railroads (including extra board men) averaged $793 a month in 1970. Freight service firemen averaged $960 monthly on freight trains. Road passenger firemen averaged $1,030 monthly.

In 1970, firemen in yard service worked a basic 8-hour day and 40-hour week, and 1½ times the basic hourly rate was paid for work beyond these hours. On many roads, the amount that firemen in road service could earn in a single month was governed by mileage limitations agreed upon by the unions and the railroad companies. Whenever a fireman on one of these roads reached this limit, his assignment for the rest of the month was taken over by another fireman—usually a man on the extra board.

Firemen often must work at night and on weekends and holidays because train schedules require 24-hour-a-day service. Road service often requires that they be away from their home stations for varying periods of time. Irregular working hours are particularly common among men on the extra board and in road freight service. Extra board men tend to have less work and therefore lower incomes than firemen with regular assignments. On many roads, the amount of work varies from one season of the year to another.

Workers in this occupation on all major roads are covered by union contracts. The great majority of firemen are represented by the United Transportation Union. Some are members of the Brotherhood of Locomotive Engineers (Ind.).

CONDUCTORS

(D.O.T. 198.168)

Nature of the Work

Conductors are responsible for seeing that railroad trains are moved according to train orders or other instructions. They are responsible for the safety of their passengers and cargoes, and they supervise the work of the train and engine crews.

Before a freight or passenger train leaves the terminal, the conductor receives the train orders from the dispatcher and confers with other crew members to make sure they understand the orders. During the run, he sees that the train cars are inspected periodically and, if problems are reported, arranges either for repair of mechanical breakdowns while the train is on its run, or for defective cars to be removed on the nearest siding. At stops, he signals to the engineer the proper time for departure. As the superior officer on the train, the conductor takes charge in any emergency that may occur during the run and all members of the train crew are subject to his instructions.

On freight trains, the conductor keeps a record of contents and destination of each car and sees that freight cars are picked up and set out along the route. On passenger trains, the conductor collects tickets and cash fares.

Yard conductors, often called "yard foremen," direct the work of the switching crews who put trains together and break them up. In mechanized yards, yard conductors operate consoles that electrically control the alinement of track switches. Class I line-haul railroads employed about 37,800 conductors in 1970.

Training, Other Qualifications, and Advancement

Openings for conductors are filled on a seniority basis by promotion of qualified brakemen. To qualify for promotion, a man usually must have several years' experience as a brakeman and pass examinations covering signals, air brakes, timetables, operating rules, and related subjects. On some roads, those who have qualified for promotion are first given temporary assignments as conductors while still working as brakemen; on other roads, they are put on the extra board as conductors and given temporary assignments as men are needed. In either case, as regular conductor assignments become available, these are assigned to men having the greatest seniority.

On most roads, conductors in yard service and in road service have separate seniority lists, and they usually remain in one of these two types of service throughout their careers. A few roads, however, start conductors on yard assignments and then move them to freight service and finally to passenger service.

Young men planning a career as a railroad conductor must have a background of honesty and be able to accept responsibility. Physical stamina is needed because of the long hours spent standing and walking. The aspiring conductor should have the patience and ability to work in other positions while aquiring the necessary seniority for a conductor's position. Promotion to conductor is limited by the availability of such positions.

The conductor is the member of the train crew who has the most direct contact with the public, and it is important that he be able to act effectively as the railroad's representative. Conductors who show special ability of this kind may advance to managerial positions such as trainmaster, if available.

Employment Outlook

There will be a moderate number of opportunities for brakemen to be promoted to jobs as conductors during the 1970's. Since conductors compose one of the oldest age groups in the Nation's work force, job openings will develop to replace those who retire, die, or leave railroading for some other reason.

The number of conductors has been declining for a number of years because of the decline of passenger traffic, the trend toward longer freight trains, and the mechanization of yard operations. Although more yard work will be speeded up by the use of the new devices (such as electric and electronic car classification systems and communications equipment) little change is expected in the number of conductors needed during the 1970's as expected growth in railroad freight traffic compensates for increased mechanization.

Earnings and Working Conditions

The type of service in which they are employed and the number of cars in their trains determine the basic earnings of conductors. In 1970, yard conductors employed by Class I line-haul railroads earned an average of $904 a month. In road freight service, conductors averaged $1,132 monthly. The average for passenger conductors was $1,095 and for assistant passenger conductors and ticket collectors $985 a month.

In 1970, conductors in yard service worked a basic 8-hour day and 5-day week. For work beyond these hours, they were paid 1½ times their basic wage rates. Since the pay received by passenger and freight conductors is based on a combination of miles traveled and hours worked, these conductors may receive more than their basic day's pay for a trip.

Like all other road crew members, conductors in freight or passenger service often are scheduled to work nights, weekends, and on holidays. Conductors on extra board work often have irregular hours. They also may work less time than conductors with regular assignments and, therefore, earn less.

Conductors on every major railroad are covered by union contracts negoitiated by the United Transportation Union.

BRAKEMEN

(D.O.T. 910.364 and .884)

Nature of the Work

Brakemen work with conductors as members of the train crews on freight and passenger trains; they work also in railroad yards. One brakeman (or "flagman") generally is stationed in the rear of each freight and passenger train. His duties include seeing that proper flags, warning lights, and other signals are displayed at the rear of the train to protect it while it is in motion and at stops. Most freight and passenger trains carry at least one other brakeman stationed in the front end of the train; his duties include setting out signals to protect the front of the train at unexpected stops. Class I line-haul railroads employed about 74,000 brakemen in 1970.

Before their train leaves the station, these brakemen in road service check the air brake equipment on the cars for proper functioning and see that tools and other equipment are in their proper places. During a run, they make frequent visual inspections of their train from their positions at both the head and rear end of the train, looking for smoke, sparks or other indications of sticking brakes, overheated car bearings, or other equipment malfunctions. At stops during the run, they make "walking inspections" of cars in the train; when necessary, they couple and uncouple cars and air hoses and help the conductor in setting out and switching cars at industrial sidings. They are responsible for regulating air-conditioning, lighting, and heating equipment in passenger cars. In passenger service, brakemen (also known as "trainmen") sometimes assist the conductor by collecting tickets and generally looking after the needs of the passengers. Yard brakemen (frequently called "switchmen" or "helpers") assist in putting together and breaking up trains by throwing switches, coupling and uncoupling freight and passenger cars, and applying or releasing handbrakes on cars to control their movement.

Training, Other Qualifications, and Advancement

A brakeman starting out as a new worker first makes several trial trips with an experienced brakeman or conductor, during which he familiarizes himself with the road and receives instructions about his duties. After he has demonstrated his ability on trial trips, the new brakeman is put on "extra board" work and given temporary assignments as men are needed. Brakemen generally must work at least a year on the extra board before they learn the job thoroughly, and several more years before a vacancy occurs and they acquire enough seniority to move on to regular assignments.

Employers prefer as applicants high school graduates or the equivalent, 18 years of age (21 on some roads) to 35. Applicants must be able to pass physical examinations with particularly strict requirements as to eyesight and hearing.

Young persons who wish to become brakemen should also have mechanical ability and be able to concentrate on detail and follow a certain amount of routine. Physical stamina is required of brakemen who do much standing, climbing and walking and are exposed to all kinds of weather conditions.

Yard brakemen may advance to yard conductors; usually they stay in yard service throughout their railroad careers. On some roads, brakemen in road service may move from freight service to passenger work, usually considered more desirable because it is less strenuous than freight service and sometimes involves shorter working hours.

With sufficient seniority, brakemen in road service may advance to conductors. Less frequently, they take positions as baggagemen. Conductor positions are almost always filled by promoting brakemen who have passed written and oral examinations on signals, timetables, brake systems, and operating rules. Promotions take place according to seniority rules, 10 years or more may be required for a brakeman to get his first assignment as a conductor. Advancement is of course limited by number of jobs available as conductors, and the number of jobs as conductor has been declining for a number of years.

Employment Outlook

Several thousand opportunities for new workers to obtain jobs as brakemen will develop through the 1970's, almost entirely as a result of retirements and deaths and because some brakemen will be promoted to jobs as conductors or transfer to other work.

Brakeman signals freight train through the yards.

The number of brakemen employed has declined for a number of years. During the early 1970's, work in railroad yards is expected to become increasingly mechanized, using automatic car retarders, automatic switching, and other devices. These developments are expected to result in a further decline in the employment of brakemen during this period.

Earnings and Working Conditions

The number of cars in the train and the type of service in which he is employed determine the earnings of a freight brakeman. The average monthly earnings of yard brakemen employed by Class I line-haul railroads were $746 in 1970. Brakemen on freight trains averaged $931 a month. The monthly average for passenger train brakemen was $844 in 1970.

In 1970, brakemen in yard service had a 5-day, 40-hour basic workweek; for work beyond this, they were paid 1½ times their regular hourly rates. In addition, brakemen in road, passenger, or freight service earned extra pay under certain conditions; for example, when they traveled more than 100 miles on a freight run or 150 miles on a passenger run.

Like other members of train and engine crews, brakemen often are scheduled to work nights, weekends, and holidays. Brakemen on the extra board and employed by the railroad for only a short time have less steady work and lower earnings than they would have on regular assignments; they also may work more irregular hours. Yard and freight brakemen face greater accident risks than most other railroad workers.

Brakemen are represented by the United Transportation Union.

TELEGRAPHERS, TELEPHONERS, AND TOWERMEN

(D.O.T. 236.588 and 910.782)

Nature of the Work

Telegraphers, telephoners, and towermen control movement of trains according to instructions issued by train dispatchers. Telegraphers and telephoners receive train orders from the dispatchers and pass them on to the train crews. Towermen operate controls which throw track switches; they also set signals to route traffic according to either train schedules or special orders. To some extent, the three jobs are interchangeable. For example, many towermen also act as telegraphers and telephoners in transmitting orders, or spend part of their time operating signals. Telegraphers, telephoners, and towermen work in towers located in yards, terminals, and other important junction points. Often, at the larger facilities and signal towers, a chief telegrapher, a chief telephoner, or wire chief, or a chief towerman (train director) is in charge of the work.

Training, Other Qualifications, and Advancement

Most receive their training on the job, working under the supervision of experienced telegraphers, station agents, or towermen to learn their future responsibilities, including operating rules, train orders, and station operations. On most roads, trainees must pass examinations on train operating rules, as well as practical tests on other duties relating to their future assignments before they can qualify.

Most roads place newly qualified workers on the extra board, where they serve on temporary assignments as men are needed. After acquiring sufficient seniority, they bid for regular assignments as telegraphers, towermen, clerk-telegraphers, and station agent telegraphers.

Most railroads prefer applicants to be high school graduates between 21 and 30 years of age. Applicants must pass physical examinations which have strict eyesight and hearing requirements. They may not be colorblind. Manual dexterity and good eye-hand coordination are necessary for operation of the many switches and keys.

Applicants for these positions should be able to accept responsibility. They should be mentally alert and capable of working efficiently in emergency or pressure situations. The ability to organize one's thoughts and actions is important. Also, the capacity to work in confined areas may be required.

A man with the necessary qualifications may advance to station agent or train dispatcher.

Employment Outlook

There will be some opportunities for new workers to become student operators each year through the 1970's. The openings that occur will result primarily from the need to replace experienced workers who retire or die.

Employment of Class I line-haul railroads telegraphers, telephoners, and towermen has declined for many years and in 1970 was about 12,000. The mechanization of yard operations, the use of dispatcher-to-train radio hookups and other new communications devices, and the extension of centralized traffic control and other automatic signaling systems are reducing the number of workers needed to help control the movement of trains.

Earnings and Working Conditions

The average straight-time hourly earnings of clerk-telegraphers and clerk-telephoners on Class I line-haul railroads in 1970 were $3.53; telegraphers, telephoners, and towermen averaged $3.58. Chief telegraphers and telephoners and train directors averaged, respectively, $4.00 and $5.07 an hour.

Telegraphers worked a basic 40-hour week of five 8-hour days in 1970, with time and one-half paid for overtime. Under Federal law, telegraphers, whose duties involve the movement of trains, are prohibited from working more than 9 hours in any one day, except in emergencies.

Telegraphers, telephoners, and towermen are members of the Brotherhood of Railway, Airline and Steamship Clerks.

STATION AGENTS

(D.O.T. 211.468 and 910.138)

Nature of the Work

Station agents are the railroads' official representatives in dealing with the public at railroad stations. Most agents work at small stations where they perform a variety of tasks. These include selling tickets, checking baggage, calculating freight and express charges, and loading and unloading freight and express packages. They may serve also as telegraphers and telephoners, receiving and delivering train orders and other messages. At stations where supervisory agents are employed, some of this work may be done by clerks, telegraphers, and others working under the agent's supervision. In major freight and passenger stations the duties of the station agent are primarily administrative and supervisory.

About 9,600 station agents were employed by Class I line-haul railroads in 1970. Many of them acted as telegraphers and telephoners in addition to their other duties. The short-line railways employed several hundred other agents, chiefly at small stations.

Training, Other Qualifications, and Advancement

Agents in small stations or assistant agents in larger ones have usually been advanced from telegraphers jobs. In addition to the necessary seniority, an agent should have a knowledge of train schedules and routes, rates, bookkeeping methods, and details of other railroad business transacted at wayside stations.

Station agents may advance from small to larger stations or from assistant agents to agents. They may be promoted to supervisory positions such as station-master or inspector.

Employment Outlook

A limited number of opportunities will arise each year through the 1970's, principally because of the need to replace experienced agents who retire or die. For several years the number of station agents employed by Class I line-haul railroads has been declining, principally because some local passenger and freight services have been consolidated or discontinued. Further cuts or consolidation may affect passenger and freight services over the next decade, resulting in employment of fewer station agents. However, if rapid transit rail systems are developed on a large scale, this trend may be slowed.

Earnings and Working Conditions

The earnings of station agents vary. In 1970, agents who also served as telegraphers and telephoners on Class I line-haul roads averaged $3.60 an hour; other agents at small stations who did not act as telegraphers averaged $3.94 an hour. Agents at major stations earned a straight-time average of $4.77 an hour.

Agents are paid either by the hour or by the month; those in nonsupervisory positions have a basic 40-hour workweek and time and one-half is paid for overtime work.

Station agents, except for some supervisory agents, are members of the Brotherhood of Railway and Steamship Clerks.

CLERKS

(D.O.T. 219.388 and .488; 222.368 through .687; 229.368; 231.682; 249.368; 910.368; 910.688; 913.168; and 919.138)

Nature of the Work

Railroad clerks handle the huge volume of paper work necessary to account for each piece of the company's rolling stock, and to transact business with freight shippers and the traveling public. They work in railroad stations, freight houses, yards, terminals, and company offices, making up the largest single group of railroad employees. Class I line-haul railroads employed about 90,000 of these workers in 1970 and short-line railways, thousands more.

The majority of railroad clerks —54,000 on Class I line-haul railroads in 1970—handle business transactions. These include collecting bills, adjusting claims, and tracing shipments. Today, however, clerks do much of this work with computers and other electronic business machines. In small offices and stations, one man may perform duties related to several of these jobs; but in large offices, a specific job.

A second group, totaling 16,000 in 1970, consists of secretaries, stenographers, typists, and operators of calculating, bookkeeping, and other kinds of office machines. They perform duties like those of workers in the same kinds of jobs in other industries. (Information about the nature of the duties of employees in these clerical jobs may be found elsewhere in the *Handbook.*)

About 8,800 other railroad clerks were in higher grade "senior" jobs involving more responsible or technical work. Some prepare statistics on employment, traffic, and other matters relating to railroad operations. Others, called "cashiers," deal with customers on matters such as uncollected freight bills. Still others account for their companies' use of terminals and other facilities owned jointly by several roads.

A fourth group are the supervisory and chief clerks, who numbered about 11,200 supervising the work of other railroad clerks and assuming responsibility for clerical activities of entire departments.

Training, Other Qualifications, and Advancement

Beginning railroad clerk positions often are filled by hiring newcomers or by promoting existing workers. A high school education is usually required, and clerical aptitude tests sometimes given. Railroads prefer workers who have had training or some experience in working with figures. In some clerical positions—yard clerk for instance—beginning workers may be assigned to extra board work, until regular assignments become available.

In many offices, a railroad clerk may advance to assistant chief clerk or to a higher administrative position; in others, to work requiring special knowledge of such subjects as accounting or statistics. Eventually he may become an auditor or statistician or be promoted to traffic agent, buyer, storekeeper, or ticket or station agent.

Employment Outlook

Several thousand job opportunities for new railroad clerks will be available each year through the 1970's to replace workers who retire, die, or transfer to other fields of work.

Employment in this occupational group has been declining for a number of years. A continued decrease is expected during the 1970's, as electronic business machines do more work formerly done by railroad clerks.

Earnings and Working Conditions

Employees of Class I line-haul railroads who had clerical jobs involving work such as billing operations, filing, and inventory control, received average straight-time pay of $3.60 an hour in 1970. Secretaries, stenographers, typists, and office machine operators averaged $3.71 an hour; senior clerks and specialists averaged $4.20 an hour; and supervisory and chief clerks, $4.45 an hour. Railroad clerks in nonsupervisory positions work a basic 8-hour day and 40-hour week, with time-and-one-half paid for overtime.

The Brotherhood of Railway, Airlines, and Steamship Clerks, Freight Handlers, Express and Station Employees represents the railroad clerks on all major roads.

SHOP TRADES

Nature of the Work

The skilled workers employed by the railroads to build, maintain, and repair rolling stock and other equipment may be classified in six main "shop crafts": *Carmen* (D.O.T. 622.381), *machinists, electrical workers, sheet-metal workers, boilermakers, and blacksmiths.* They work on rolling stock and other equipment in railway shops, enginehouses, yards and terminals.

In 1970, about 82,500 journeymen mechanics in these six crafts were employed by Class I line-haul railways. Working with them were 6,300 gang foremen and leaders, 7,100 helpers, and 3,500 apprentices. Several thousand more workers in the same occupations were employed by short-line railways.

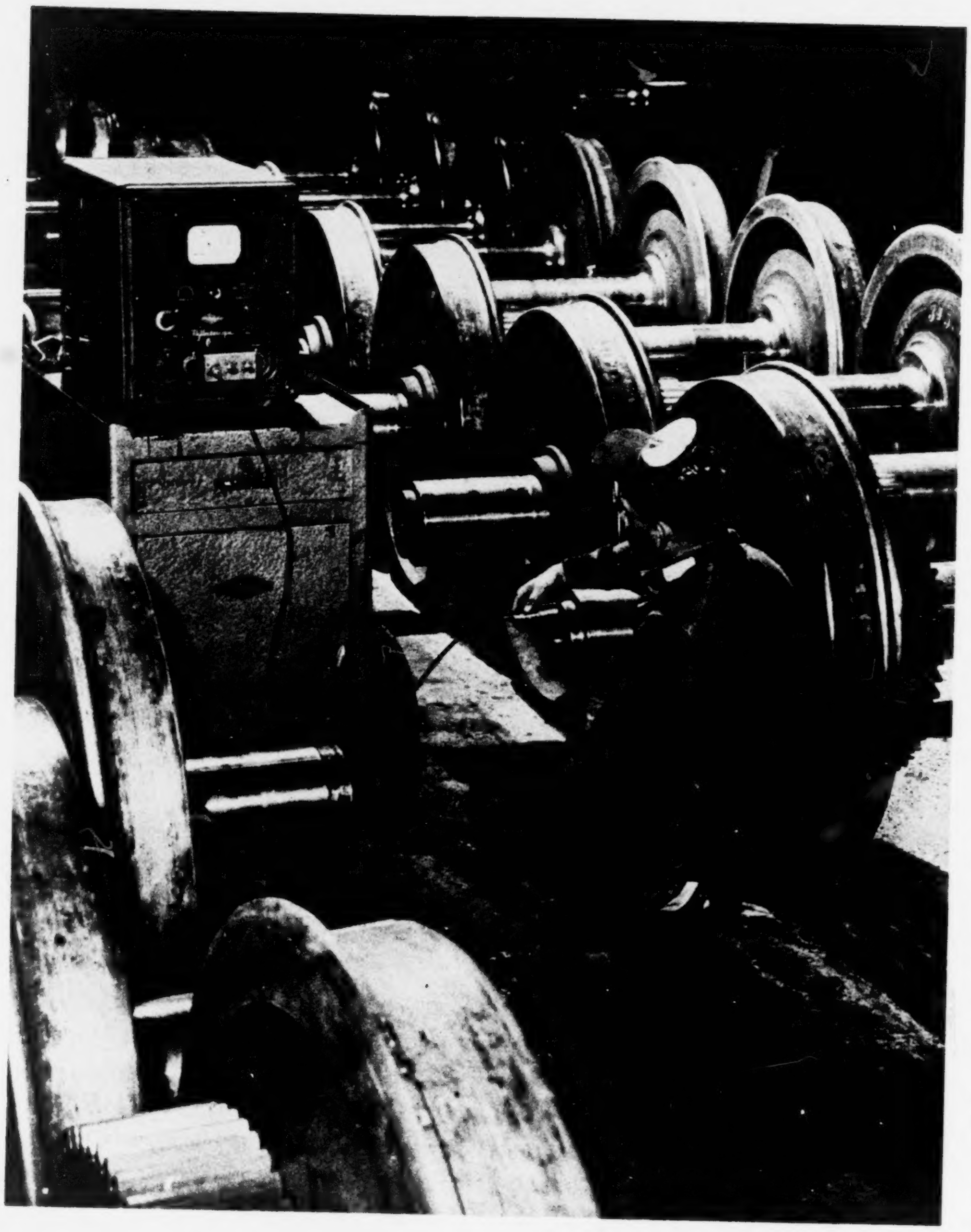
Carmen, who numbered about 45,000 on Class I line-haul railroads in 1970, are by far the largest group. They do many different kinds of work, building, maintaining, and repairing both freight and passenger cars. They also work on both locomotives and small vehicles—motor-driven cars that transport workers along the tracks. Some carmen are skilled in carpentry and can use power equipment as well as handtools. A few others are skilled only in specialties such as upholstering, car painting, and patternmaking. Many carmen work in railroad yards and stations as car inspectors examining cars for defects that might lead to accidents or delays.

Machinists are the second largest group of skilled shop workers. About 17,000 were employed in 1970, maintaining and overhauling locomotives and machinery used by the railroads. *Electrical workers,* who numbered about 11,500 in 1970, install and maintain wiring and electrical equipment in locomotives, passenger cars, and cabooses, as well as in railroad buildings. Another group of electrical workers employed mainly away from the shop, lay power and communications lines for equipment used by the railroads. *Sheet-metal workers,* numbering about 5,200 in 1970, install and maintain light sheet-metal parts and do pipefitting on locomotives and other equipment. *Boilermakers,* of whom there were about 1,550 in 1970, maintain and repair stationary boilers, tanks, and other parts made of sheet iron or heavy sheet steel. Other craftsmen employed in the shops include blacksmiths, molders, stationary firemen, oilers, and stationary engineers (steam). (More information about the nature of the work of most of the above shop trades may be found elsewhere in the *Handbook.*)

Training, Other Qualifications, and Advancement

Apprenticeship training is a common way of entering the shop trades; others are upgraded from the ranks of helpers and laborers, or enter the industry as shop craftsmen.

Apprentices are trained in all branches of their respective trades;



Shop worker checks for flaws in locomotive axles.

standards, in many cases, are included in agreements between trade unions and railroad companies. Beginners with no previous experience in their chosen trades train as regular apprentices to be certified as qualified journeymen. Men with at least 2 years of previous work experience train as helper apprentices for a 3-year period.

To become an apprentice, the applicant must be between 16 and 21 years of age; helpers, entering the 3-year apprentice training, usually are no older than 35. On some roads, applicants for apprentice training must pass mathematical and mechanical aptitude tests.

Workers in the shop trades may advance to supervisory positions as foremen in shops, enginehouses and powerplants.

Employment Outlook

Nationwide there will be only a few hundred opportunities for new workers to obtain jobs as helpers or as apprentices in the shop crafts each year during the next decade.

Openings in the skilled shop crafts will result primarily from the need to replace experienced craftsmen who retire, die, or transfer to other fields of work, rather than from employment growth.

The number of journeymen mechanics employed in these crafts has declined for a number of years, and some further decline appears likely through the 1970's, although more rolling stock may be needed to handle the anticipated increase in freight traffic. Railroads now handle a given amount of work in shops with a smaller work force than formerly because of: the use of assembly-line techniques in repair work; greater specialization of labor; and use of better designed and constructed rolling stock. Also, fewer equipment maintenance employees are needed because some railroads send diesel locomotives, requiring major overhaul, to the manufacturer for rebuilding or replacement by more highly powered new or rebuilt units.

Employment trends for individual shop crafts are not affected equally by changes in equipment and operating methods.

Some increase in employment of electrical workers may occur through the 1970's because of installation of more complex electrical and electronic equipment in locomotives, railroad cars, and communication systems. During this same period, declines in employment of carmen, machinists, and boilermakers are expected.

Earnings and Working Conditions

Straight-time average hourly

earnings of journeymen employed by Class I line-haul railroads in the shop trades in 1970 were: Carmen, $4.14; machinists, $4.22; electrical workers, $4.22; sheet-metal workers, $4.22; boilermakers, $4.22; and blacksmiths, $4.17. Straight-time earnings of helpers in all shop crafts averaged $3.48 an hour. Regular apprentices, who spend part of their time in classroom instruction and the rest on the job, averaged $3.16 an hour; and helper-apprentices, who also worked on the same basis, averaged $3.58 an hour. Gang foremen and gang leaders averaged $4.79 an hour. Most shop workers have a basic 40-hour workweek of five 8-hour days and are paid time and one-half for overtime.

Major repairs on locomotives and cars are generally made indoors in the enginehouse or the car repair shop. Minor adjustments, inspection, and emergency repairs may be performed out-of-doors.

Most shop workers are members of unions. Among the unions in this field are: Brotherhood Railway Carmen of America; International Association of Machinists and Aerospace Workers; International Brotherhood of Electrical Workers; Sheet Metal Workers' International Association; International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers; and the International Brotherhood of Firemen and Oilers. In collective bargaining, these unions usually negotiate their labor contracts through the Railroad Employees' Department of the AFL-CIO.

SIGNAL DEPARTMENT WORKERS

(D.O.T. 822.281 and .884)

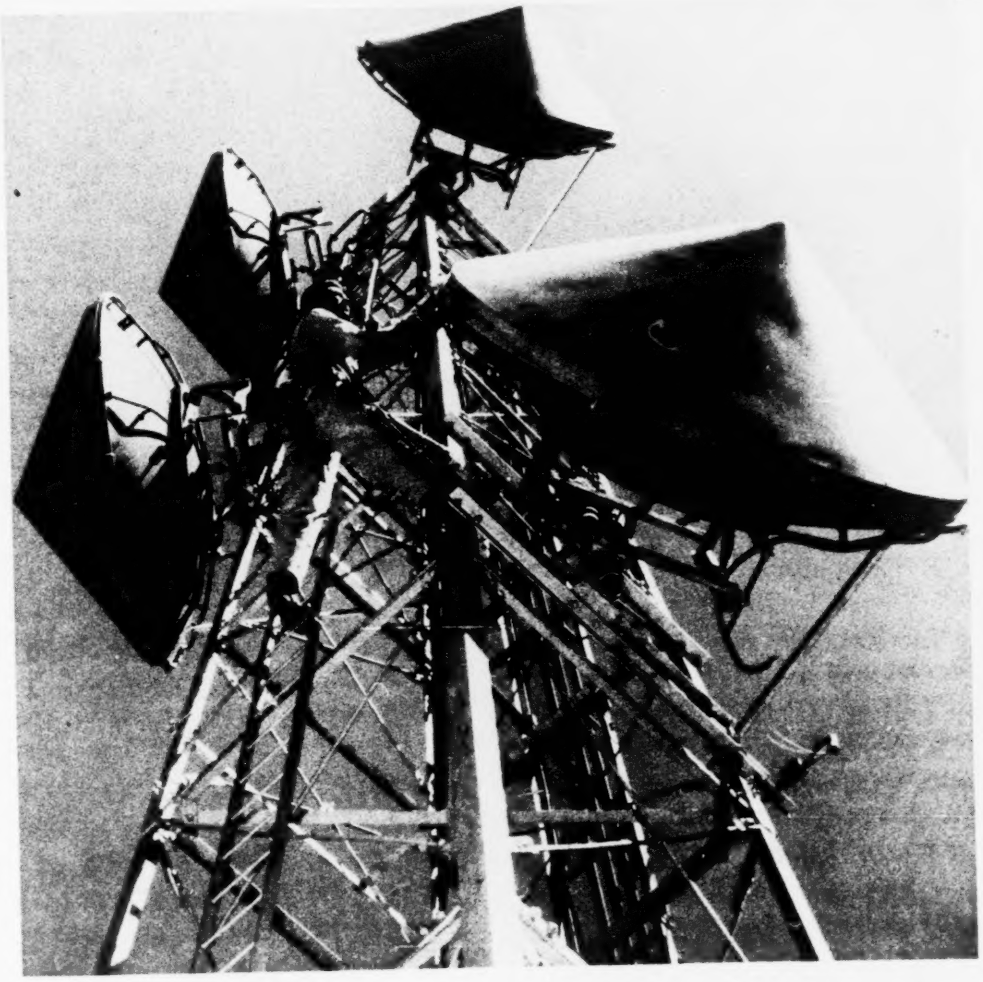
Nature of the Work

Workers in railroad signal departments work with the signaling systems which control movement of trains and assure safety of railroad travel. Tasks involve constructing, installing, maintaining, and repairing these systems.

One group of skilled workers, known as signal maintainers, keep wires, lights, switches, and other controlling devices in good operating condition. The work requires a thorough practical knowledge of electricity and considerable mechanical skill, and, for work on the newer signaling systems, a knowledge of electronics.

A second skilled group, known as signalmen, generally has the same skills and knowledge but constructs and installs new signals and signal systems. Signalmen work as members of crews (which also include semiskilled workers) that travel from one part of the road to another, wherever construction work is underway. In constructing a signal system, crews often build forms for concrete, mix and pour cement, weld metal, and do many other types of work in addition to electrical work.

In 1970, Class I line-haul railroads employed about 12,000 men



Microwave installations are part of the up-to-date communications systems.

in this kind of work; included were about 8,000 signalmen and signal maintainers, about 1,150 semiskilled assistants, and 7,000 helpers. Several hundred workers in these groups also were employed by the short-line railways and by switching and terminal companies.

Training, Other Qualifications, and Advancement

Railroads prefer that applicants be between 18 and 35 years of age and have a high school education or its equivalent. Knowledge of electricity and mechanical skill are assets.

New employees start as helpers under the direction of experienced men, or with previous experience as assistants. Helpers, after about 1 year of training, usually advance to assistant. Openings for signalmen and signal maintainers are filled by promoting qualified assistants, according to seniority rules. At least 4 years are usually required.

Both signalmen and signal maintainers may be promoted to more responsible positions such as inspectors or testmen, gang foremen, leading signalmen, or leading signal maintainers. A few may advance eventually to assistant supervisors or signal engineers.

Employment Outlook

There will be some opportunities for new workers to obtain entry jobs as helpers or assistants during the 1970's, mostly from the need to replace existing workers who retire, die, or transfer to other fields of work. Job openings will be limited, because men laid off in recent years will be recalled before new men are hired.

Employment of signal department workers has declined for a number of years. These occupations are expected to continue to decline slowly in the 1970's, as improved signaling and communications systems require less maintenance and repair.

Earnings and Working Conditions

The average straight-time hourly earnings of signalmen and signal maintainers employed by Class I line-haul railroads in 1970 were $3.92. Assistant signalmen and signal maintainers averaged $3.34 and helpers, $3.25 an hour. Signal workers have a basic 8-hour day and 5-day week, and are paid time and one-half for work beyond 8 hours a day.

Since the amount of work required for maintaining railroad signal systems is not affected greatly by variations in traffic or by the seasons, signalmen and other crew members may have less-than-full-time work during especially bad weather. For both groups, the work is done mostly outdoors and maintainers must make repairs regardless of time of day or weather conditions. Both maintainers and signalmen must often climb poles and work near high-tension wires and unguarded tracks.

In working on construction and installation, signalmen and other crew members frequently work away from their homes; many railroads provide camp cars for living quarters while the men pay for their own food. Signal maintainers generally are able to live at home, maintaining signals over only a limited stretch of track.

Most signal workers are members of the Brotherhood of Railroad Signalmen.

TRACK WORKERS

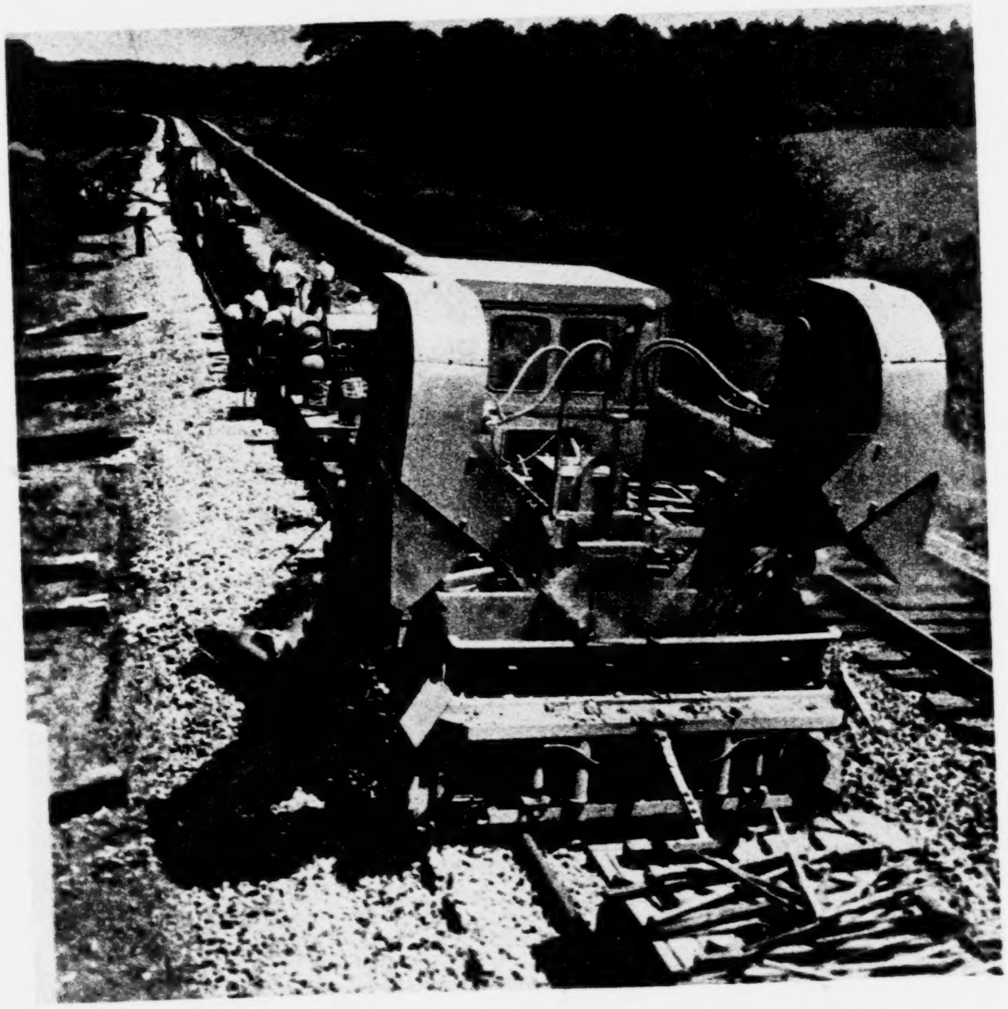
(D.O.T. 182.168; 859.883; 869.887; 910.782; and 919.887)

Nature of the Work

Trackmen and portable equipment operators construct, maintain, and repair railroad tracks and roadways. Many work in section crews which patrol and maintain a limited section of the railroad's right-of-way. Other trackworkers are employed with highly mechanized crews to cover longer stretches of the right-of-way. Still others are employed in "extra" crews, performing seasonal maintenance and repair work, such as replacing rails.

After some track workers make regular inspections of the right-of-way, (looking for cracked rails, weak ties, washed out ballast, and other track and roadway defects), trackmen and portable equipment operators make necessary repairs. Roadway maintenance machines—such as multiple tie tampers, power wrenches, and ballast cleaners—have been displacing gradually the use of such handtools as picks, shovels, and spike hammers. More and more railroads are using roadway machines, which require skilled operators in place of trackmen using hand or pneumatically-powered tools.

In 1970, an average of 56,000 track workers were employed by Class I line-haul railroads. They included 35,600 trackmen working in crews, 9,800 portable equipment operators and helpers, and 10,500 gang foremen. Additional thousands were employed by the short-line railroads. The size of this work force varies considerably during the year because many construction and repair jobs are done in summer.



Modern machines make track maintenance a production-line operation.

Training, Other Qualifications, and Advancement

Most track workers are trained on the job. To acquire the necessary skills requires up to 2 years. Machine operating jobs are assigned to qualified trackmen on the basis of seniority.

Most roads prefer workers between the ages of 21 and 45, who must be able to read and write and to do heavy work. Applicants often are required to take physical examinations. A high school education is desirable to advance to portable equipment operator and gang foreman.

Trackmen and portable equipment operators who have the necessary seniority and qualifications may advance to gang or assistant foreman, then to a supervisory maintenance-of-way position such as track supervisor.

Employment Outlook

Several thousand new workers will be hired each year in track maintenance occupations during the 1970's, mostly for the seasonal rush during the summer months. Comparatively few openings will offer steady year-round employment.

For some years, the use of mechanized equipment and new kinds of materials in roadway construction has been reducing substantially the number of men employed. At the same time, however, use of mechanized equipment has created a limited number of maintenance-of-way jobs as operators of roadway machines. These trends are expected to continue.

Earnings and Working Conditions

Track workers are among the lowest paid groups in the railroad industry. Men employed in section and other kinds of crews on Class I line-haul railroads had straight-time average earnings of $3.59 an hour in 1970. Portable equipment operators and helpers averaged $3.53 and crew foremen averaged $3.67 an hour in 1970. A basic 5-day, 40-hour week was in force for most classes of track workers. Time worked over 8 hours a day was paid for at time and one-half rates.

Since most section men inspect and maintain only a few miles of track, they usually live at home. However, the section crew is giving way rapidly to the mechanized "floating" crew, who with their portable equipment usually travel from place to place, generally living in camp cars or trailers provided by the railroads and paying for their own food.

Most maintenance-of-way workers are members of the Brotherhood of Maintenance of Way Employes.

BRIDGE AND BUILDING WORKERS

Nature of the Work

These workers construct, maintain, and repair the tunnels, bridges, stations, railway shops, and other structures owned by the railroads.

In 1970, Class I line-haul railroads employed about 8,300 skilled craftsmen, 2,440 helpers, and 2,140 foremen in this kind of work. Among the skilled craftsmen were 4,680 carpenters working as all-round mechanics in a variety of construction trades in addition to carpentry; about 2,700 masons, bricklayers, plasterers, and plumbers; and about 500 painters and 365 ironworkers. The short-line railways employed several hundred more workers in the same occupations. (Information about the nature of the work done by these craftsmen can be found elsewhere in the *Handbook.*)

Training, Other Qualifications, and Advancement

New employees usually receive their training as helpers. As openings occur in skilled mechanics' jobs, they are filled by helpers who have qualified for promotion and have the necessary seniority.

Skilled workers who have the necessary experience may advance to positions as foremen, inspectors, or bridge and building supervisors.

Employment Outlook

A small number of job openings in the bridge and building work force will arise each year during the 1970's. Retirements, deaths, and transfers of existing workers to other fields of work will provide some job opportunities for new workers. Most jobs available will be as beginners or helpers, where turnover rates are relatively high.

Employment by Class I line-haul railroads of skilled craftsmen, helpers, and foremen on bridge and building work has decreased for a number of years. This trend is expected to continue because of the increased use of power tools and other laborsaving equipment, and of new materials which require less maintenance and repair. Another cause has been lack of new building in the industry.

Earnings and Working Conditions

The average straight-time hourly earnings of carpenters employed by Class I line-haul railroads in bridge and building work in 1970 were $3.51. Masons, bricklayers, plasterers, and plumbers averaged $3.78; iron-workers, $3.80; painters, $3.55; helpers, $3.19; and foremen, $3.75 an hour in 1970. Bridge and building workers work a 5-day, 40-hour week and are paid time-and-one-half for work beyond 8 hours a day; they may receive double time for work over 16 continuous hours.

If bridge and building men are away from home during their workweek, they usually live in camp cars supplied by the railroads, but pay for their own food.

The Brotherhood of Maintenance of Way Employes represents the bridge and building workers on most roads.

TELEPHONE INDUSTRY OCCUPATIONS

As our population and economy grow and technology advances, the need for communication increases. More than 460 million local and long-distance telephone calls are made daily in the United States, and overseas. In early 1970, approximately 935,000 employees were required to provide this service.

The telephone industry offers men and women steady, year-round work in many different jobs. Some jobs, such as telephone operator and file clerk, can be learned in a few weeks; other jobs, such as installer and repairman, require many months.

More than half of all telephone workers are women employed mostly as clerks or telephone operators. Men usually are employed to install, repair, and maintain telephone equipment.

Nature and Location of the Industry

Providing telephone service for the many millions of residential, commercial, and industrial customers is the main work of the Nation's telephone companies. More than 120 million telephones were in use in the United States in 1970.

Telephone jobs are found in almost every community in the United States. Most telephone workers, however, are employed in large cities where concentrations of industrial and business establishments are located. Nearly three-fifths of them work in the 10 States which have the largest number of telephones: California, New York, Pennsylvania, Illinois, Ohio, Texas, Michigan, New Jersey, Florida, and Massachusetts. The nerve center of the local telephone system is the central office, containing the switching equipment through which a telephone may be connected with any other telephone. Every telephone call made, whether by dialing direct or signaling the operator, travels from the caller through wires or micro-wave radio and cables to the cable vault in the central office. Thousands of pairs of wires fan out from the cable vault to a distributing frame where each set of wires is attached to switching equipment. Electromechanical, switching equipment and to a lesser-but-growing extent electronic switching equipment make connections automatically. In a few remaining switchboards and in unusual situations an operator makes the connection manually.

Long-distance calls are dialed by the customer or an operator and connected with the telephone called through switching equipment. During 1970, over 90 percent of all telephone users could dial long-distance calls directly. Information needed to bill the customer may be recorded automatically or, on operator handled calls, is entered on a ticket by the operator.

Some customers make and receive more calls than can be handled on a single telephone line. For these calls, a system somewhat similar to a miniature central office may be installed on the subscriber's premises. This system is the private branch exchange (PBX), usually found in places such as apartment and office buildings, hotels, department stores, and other business firms.

A new type of service is called CENTREX, in which incoming calls can be dialed direct to any extension without an operator's assistance, and outgoing and intercom calls can be dialed direct by the extension users. The equipment for this service can be located either on telephone company premises or on the customer's premises.

Other communications services provided by telephone companies include conference equipment installed at a PBX to permit conversations among several telephone users simultaneously; mobile radiotelephones in automobiles, boats, airplanes, and trains; and telephones equipped to answer calls automatically and to give and take messages by recordings.

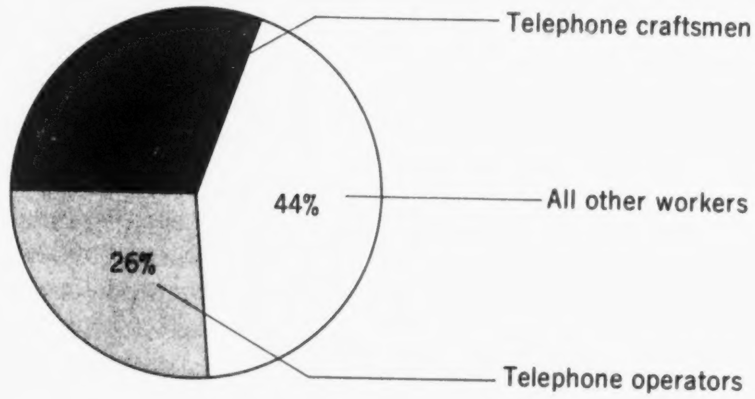
Telephone companies also build and maintain the vast network of cables and radio-relay systems for communication services, including those joining the thousands of broadcasting stations all over the Nation. These services are leased to networks and their affiliated stations. Telephone companies also operate teletype and private-wire services which they lease to business and government offices.

About 5 out of 6 of the Nation's domestic telephones are owned by the Bell System. The independents serve the remainder. There are approximately 1,900 independent telephone companies in the United States. General Telephone and Electronics Corporation in New York City, United Utilities, Inc. in Kansas City, and Continental Telephone Corporation in St. Louis account for about 3 out of every 5 telephones serviced by independent telephone companies.

Telephone Occupations

Although the telephone industry requires workers in many different

㉞ **Telephone craftsmen and operators make up more than one-half of all workers employed in the telephone industry**



SOURCE: BUREAU OF LABOR STATISTICS

occupations, telephone craftsmen and operators make up more than one-half of all workers (see chart 34).

Telephone craftsmen install, repair, and maintain telephones, cables, switching equipment, and message accounting systems. These workers can be grouped by the type of work they perform: (1) construction people place, splice, and maintain telephone wires and cables; (2) installers and repairmen place, maintain, and repair telephones and private branch exchanges (PBX) in homes and offices and other places of business; and (3) central office craftsmen test, maintain, and repair equipment in central offices.

Operators make telephone connections; assist customers in specialized services, such as reverse-charge calls; and give telephone information. Telephone craftsmen are discussed in detail later in this chapter. A detailed discussion of telephone operators and operators of private branch exchanges (PBX operators) is presented in a separate statement elsewhere in the *Handbook*.

Central office equipment purchased by a telephone company, usually is installed by employees of the equipment manufacturers. A few central office equipment installers work for telephone companies or private firms specializing in installation work. Although most of these skilled workers are not employed in telephone operating companies, they are discussed in this chapter because their work is so closely connected with the Nation's telephone system.

Many other occupations in the telephone industry, such as clerical and administrative, are found in other industries as well. They are described in detail elsewhere in the *Handbook* in the sections covering individual occupations.

More than one-fifth (21 percent) of all telephone industry employees are clerical workers. These include stenographers, typists, bookkeepers, office machine and computer operators, keypunch operators, cashiers, receptionists, file clerks, accounting and auditing clerks, and payroll clerks. These clerical workers, most of whom are women, keep records of services, make up and send bills to customers, and prepare statistical and other reports. A growing amount of this record-keeping and statistical work is being done by electronic data-processing equipment.

About 14 percent of telephone company employees are business and sales representatives, who handle orders for new telephone services, and administrative and professional workers; these include accountants, attorneys, personnel specialists, purchasing agents, public relations employees, training specialists, and statisticians.

Approximately 4 percent of the industry's employees are scientific and technical personnel such as engineers and draftsmen. Most of these workers plan and design new buildings, the expansion of existing ones, and solve engineering problems. Engineers are employed in sales development work. Many top supervisors and administrators are men having engineering backgrounds. Basic research in communications systems and the development of new and improved equipment are not done by employees of telephone operating companies, but mainly by specialists in affiliated laboratories.

About 3 percent of the industry's workers maintain buildings, offices, and warehouses; operate and service motor vehicles; and do other maintenance and service jobs in offices and plants. Skilled maintenance craftsmen include stationary engineers, carpenters, painters, electricians, and plumbers. Other workers employed by the telephone industry are janitors, porters, watchmen, elevator operators, and guards.

Employment Outlook

Tens of thousands of new workers will be required by telephone operating companies each year throughout the 1970's, mainly to replace the large number of women telephone operators and clerical workers who leave the industry. Many new workers, however, will be needed for craft jobs to replace skilled workers who die, retire, or shift to other work. Job turnover also will create openings for administrative, sales, professional, technical, and scientific personnel.

Despite an anticipated strong growth in service, total employment is expected to grow only moderately because technological improvements such as electronic switching equipment permit more calls to be made without assistance. However, operators will continue to handle complex calls. Technological changes are expected to restrict the total number of clerks and skilled craftsmen. Occupational groups in which employment is expected to grow as business increases are sales, administrative, professional, technical, and scientific personnel.

Part of the expansion in telephone service will result from expected increases in number of households and business establishments. The remaining households in the United States without telephones will be another factor in the demand for telephone service, especially as incomes rise.

Other factors also are expected to increase demand for telephones. For example, in private homes different styles and color and telephone extensions are increasing. The recently-developed push-button instrument enables the user to call in half the time required by a dial phone. It may provide many new services, including the transmission of data, remote control of appliances, or remote access to electronic computers. Also growing is the use of specialized equipment on telephone instruments, such as volume controls that compensate for impaired hearing and housespeakers that permit "hand free" conversation.

For industrial and commercial users, high speed transmission of large quantities of computer-processed and other data via telephone, teletypewriter, telephotograph, or facsimile are becoming important. Because of high speed of data transmission, for example, the same newspaper can be published simultaneously in two widely separated cities. To meet the increasing demand for overseas communications, transoceanic service will continue to expand as more undersea cables are laid and communication satellites come into wider commercial use.

Earnings and Working Conditions

Since wage rates in the telephone industry are geared to those for comparable work in the locality, earnings of telephone workers depend not only on the type of job and the worker's previous training and experience, but also on location and character of the community. Because of differences in rates among regions and communities, considerable variation exists in the rates paid for any given telephone occupation. In general, telephone wage rates are highest in the Pacific and Middle Atlantic States and lowest in the Southeast.

For the Nation as a whole, average basic hourly wage rates in December 1969 for all telephone employees, except officials and managerial assistants, were $3.62. Rates for these workers ranged from an average of $2.16 an hour for telephone operator trainees and $2.55 for experienced telephone operators, to $6.39 for professional and semiprofessional workers. Clerical workers in non-supervisory positions averaged $2.79 an hour. Construction, installation, and maintenance employees averaged $4.01 an hour.

A telephone employee usually starts at the minimum wage for his particular job. Advancement from the starting rate to the maximum rate generally takes from 4 to 6 years and involves from 10 to 14 pay grades.

More than two-thirds of the workers in the industry, mainly telephone operators and craftsmen, are members of labor unions. The Communications Workers of America represents the largest number of workers in the industry, but many other employees are members of the 13 independent unions which form the Alliance of Independent Telephone Unions. Others are members of the International Brotherhood of Electrical Workers.

Wage rates, wage increases, and the amount of time required to advance from one step to the next are governed for most telephone workers by union-management contracts. The contracts also call for extra pay for work beyond the normal tour of 6 to 8 hours a day or 5 days a week, and for all Sunday and holiday work. Most contracts provide a pay differential for night work.

Travel time between jobs is counted as worktime for craftsmen under some contracts. Overtime work sometimes is required in the telephone industry, especially during emergencies, such as floods, hurricanes, or bad storms. During an "emergency call-out," which is a short-notice request to report to work during non-scheduled hours, workers are guaranteed a minimum period of pay at the basic hourly rate.

In addition to these provisions which affect the pay envelope directly, other benefits are provided. Annual vacations with pay are granted to workers according to their length of service. Usually, contracts provide for a 1-week vacation beginning with 6 months of service; 2 weeks for 2 to 10 years; 3 weeks for 11 to 19 years; 4 weeks for 20 to 24 years; and 5 weeks for 25 years and over. Depending on locality holidays range from 8 to 12 days a year. Most telephone workers are covered by paid sick plans and group insurance which usually provide sickness, accident, and death benefits, and retirement and disability pensions.

The telephone industry has achieved one of the best safety records in American industry. The number of disabling injuries has been consistently well below the average.

Where To Go for More Information

Additional information about jobs in the telephone industry may be obtained from the local telephone company or from local unions with telephone workers among their membership. If no local union is listed in the telephone directory, information may be obtained from the following:

Alliance of Independent Telephone Unions, Room 302, 1422 Chestnut St., Philadelphia, Pa. 19102.

Communication Workers of America, 1925 K St., NW., Washington, D.C. 20006.

International Brotherhood of Electrical Workers, 1200 15th St., NW., Washington, D.C. 20005.

United States Independent Telephone Association, 438 Pennsylvania Building, Washington, D.C. 20004.

TELEPHONE CRAFTMEN

Nearly three-tenths of the employees in the telephone industry are craftsmen engaged in construction, installation, and maintenance activities necessary to operate the vast amount of mechanical, electrical, and electronic equipment vital to the far-reaching network of our modern communications systems. About 1 out of 7 of these workers are foremen, many of whom have advanced to supervisory positions from a craft job.

CENTRAL OFFICE CRAFTMEN

Nature of the Work

Central office craftsmen test, maintain, and repair mechanical, electrical, and electronic switching equipment and other central office equipment. They maintain this equipment in operating condition and locate potential trouble before service is affected. Telephone companies employed about 92,000 central office craftsmen in 1970, including approximately 21,000 test boardmen and 66,000 central office repairmen, helpers, and framemen. Frameman (D.O.T. 822.884) is usually the beginning job from which a worker may advance to a more skilled central office craft job. Much of the frameman's job involves running, connecting, and disconnecting wires according to plans prepared by line assigners, another small group of workers.

Central office repairmen (D.O.T. 822.281), often called *switchmen*, maintain and repair switching equipment and automatic message accounting systems in central offices. They check switches and relays, using special tools and gauges. They also locate and repair trouble on customers' lines in central office equipment as reported by testboardmen.

Testboardmen (D.O.T. 822.281) check customers' lines to determine the cause of breakdowns or interference in telephone service. They work at special switchboards comprising electrical testing instruments and test for, locate, and analyze trouble spots reported on customers' lines. If repairs are needed and the breakdown is outside the central office, they direct the repair activities of line and cable crews or installer repairmen or of central office repairmen (if the trouble is inside).

Training, Other Qualifications, and Advancement

Telephone companies usually train inexperienced men for skilled jobs in central offices. Applicants must have at least a high school or vocational school education. A knowledge of the basic principles of electricity and electronics generally is desired. Telephone training and experience in the armed services or technical training beyond high school may be helpful in obtaining jobs as telephone craftsmen; men with such training may be brought in above the entry level. Preemployment aptitude tests usually are given to prospective employees.

Young persons considering ca-

Central office repairman checks automatic switching equipment.

reers as central office craftsmen should have manual dexterity, good eyesight—no color blindness, and an aptitude for mechanics and reading diagrams and blueprints. He should be able to work with others for many times teamwork is essential to solve a complex problem. Employees frequently work shifts or overtime to maintain constant telephone service. Central office craftsmen should be adaptable to changes brought about by rapid advances in communications technology.

Most telephone companies give classroom instruction and on-the-job training to new central office craft employees. Usually they are assigned to the starting job of frameman and work with experienced framemen under the direction of a supervisor or foreman. As they gain experience they may advance to central office repairmen or testboardmen to receive additional training. Instruction includes courses in the maintenance of the particular type of central office equipment used by the company.

Throughout their careers, the telephone company trains office craftsmen. As new types of equipment and tools and new maintenance methods are introduced, they may be sent to school for short periods. Usually at least 6 years are necessary for workers to reach the top pay rate for central office repairmen or testboardmen.

Many workers move into central office craft jobs from other types of telephone work. For example, some men start as installers or linemen and many, with additional training, transfer to jobs as central office craftsmen. They may then be promoted to engineering assistant or administrative staff worker.

Employment Outlook

During the 1970's many opportunities will result for central office craftsmen from the need to replace workers who retire, die, or transfer to other jobs. Retirements and deaths alone may result in several thousand job openings each year.

The total number of central office craftsmen is expected to increase rapidly during the 1970's, mainly as a result of the increasing demand for telephone service and data communication systems. However, recent technological developments, such as electronic switching and various automatic testing devices, will tend to restrict employment growth.

Earnings and Working Conditions

Central office craftsmen are among the highest paid skilled workers in the telephone industry. In December 1969, average basic hourly rates of pay in large telephone companies in the United States were $4.04 for testboardmen and $3.77 for central office repairmen; average basic hourly rates ranged from $3.80 to $4.38 for testboardmen and from $3.46 to $3.81 for central office repairmen, depending on locality and length of service.

Earnings increase considerably with length of service in central office jobs. According to a 1970 union-management contract in one of the higher pay scale cities, craft employees start at $105.50 for a 40-

hour week. Framemen can work up to a maximum of $166 after 4 years and 11 months. If a vacancy occurs and the worker is qualified, a frameman can move into the job of central office repairman or testboardman with a higher pay schedule. Central office repairmen and testboardmen can earn a maximum of $193 a week after 6 years of periodic increases.

Since the telephone industry gives continuous service to its customers, central offices operate 24 hours a day, 7 days a week. Some central office craftsmen, therefore, have work schedules for which they receive extra pay. Central office craftsmen are covered by the same provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally. (See discussion earlier in this chapter.) Employees in central offices work in clean and well-lighted surroundings.

CENTRAL OFFICE EQUIPMENT INSTALLERS

Nature of the Work

Central office equipment installers set up complex switching and dialing equipment in central offices of telephone companies. They assemble, wire, adjust, and test this equipment to have it comform to the manufacturer's standards for efficiency and dependability. They may install a new central office, add equipment in an expanding local office, or replace outmoded equipment.

About 22,000 installers were employed in 1970. Unlike other craftsmen discussed in this chapter, most installers work for manufacturers of central office equipment rather than for telephone companies. A few including about 1,600 in the New England area, work directly for telephone companies; some are employed by private contractors who specialize in large-scale installations.

Central office equipment installer wires switching equipment.

Central office equipment installers generally are assigned to areas which include several States to install a switchboard in a central office in a small community, where they may work with only one or two other installers. On a large job, such as a long-distance toll center in a big city, he may work with hundreds of other installers.

Training, Other Qualifications, and Advancement

Young persons who wish to become installers must have a high school or vocational school education. Individuals with some college education, especially engineering majors often are hired. Preemployment tests generally determine the applicant's mechanical aptitudes. A physical examination is required.

Young persons considering careers as central office craftsmen should have manual dexterity, good eyesight—no color blindness, and an aptitude for mechanics and reading diagrams and blueprints. He should be able to work with others for many times teamwork is essential to solve a complex problem. Employees frequently work shifts or overtime to maintain constant telephone service. Central office craftsmen should be adaptable to changes brought about by rapid advances in communications technology.

New employees receive on-the-job training and classroom instruction. They attend classes the first few weeks to learn basic installation methods before starting on-the-job training. After several years of experience, they may qualify as skilled installers. Training on the job, however, continues even after they become skilled workers. Additional courses are given from time to time to improve their skills and to teach new techniques in installing telephone equipment. Installers may advance to engineering assistant jobs, especially those workers who have had some technical training beyond the high school level.

Employment Outlook

Employment of central office equipment installers is expected to increase at a moderate rate during the 1970's to install equipment in thousands of new central offices and to replace obsolete equipment. A few hundred job openings a year are expected to replace office equipment installers who transfer to other work, retire, or die.

Increasingly complex central office and toll equipment, including advanced PBX systems and data and computer networks, will require more highly skilled manpower in electronics. Installers, perhaps more than other telephone craftsmen are subject to possible employment fluctuations in the short run because of changes in business conditions. When the business outlook is depressed, there is less likelihood new central offices will be built and existing offices enlarged or modernized. When business is prospering, installations, additions, and modifications of central offices may occur at an above-average pace.

Earnings and Working Conditions

According to a major union contract in 1970, rates for inexperienced installers, depending on the locality, start at $2.50 to $2.69 an hour. The contract provides for periodic increases, and employees may reach rates of $4 to $4.82 an hour after 6 years of experience. Time and a half is paid for work over 8 hours a day or 40 hours a week, and double time is paid for Sundays and holidays.

Travel and expense allowances also are given. Depending on locality installers receive 8 to 12 paid holidays a year. Length of service determines paid vacations.

The Communications Workers of America represents most central office equipment installers, including those servicing the Bell System. The International Brotherhood of Electrical Workers represents some installers employed directly by New England telephone companies, by manufacturers supplying the non-Bell or independent segment of the telephone industry, and others, employed by large installation contractors.

LINEMEN AND CABLE SPLICERS

Nature of the Work

The vast network of wires and cables that connect telephone central offices to the millions of telephones and switchboards in customers' homes and buildings is constructed and kept in good operating order by linemen and cable splicers and their helpers. Telephone companies employed over 44,000 of these workers in early 1970, 15,000 linemen, 25,000 cable splicers, and 4,000 helpers, laborers, and other workers.

In constructing new telephone lines, *linemen* (D.O.T. 822.381) place wires and cables leading from the central office to customers' premises. They use power-driven equipment to dig holes and set in telephone poles which support cables. Linemen climb the poles to attach the cables, usually leaving the ends free for cable splicers to connect later. In cities where telephone lines are below the streets, linemen place cables in underground conduits. Construction linemen usually work in crews of two to five men. A foreman directs the work of several of these crews.

Linemen repair and maintain existing lines. When wires or cables break or a pole is knocked down, linemen make emergency repairs. The line crew foreman keeps in close contact with the testboard foreman who directs him to trouble locations on the lines. Some linemen periodically inspect sections of lines in rural areas and make minor repairs and line changes.

After linemen place cables on poles or in underground conduits, *cable splicers* (D.O.T. 829.381) generally complete the line connections. Splicers work on aerial platforms, in manholes, or in basements of large commercial buildings. They connect individual wires within the cable by matching colors of wires so as to keep each circuit continuous. Cable splicers also rearrange pairs of wires within a cable when lines have to be changed. At each splice, they either wrap insulation around the wires and seal the joint with a lead sleeve or cover the splice with some other type of closure. Sometimes, they fill the cable sheathing with compressed air to keep out moisture. Cable splicers also maintain and repair cables. The preventive maintenance work that they do is extremely important because a single defect in a cable may result in a serious interruption in service. Many trouble spots are located through air pressure or electric tests.

Training, Other Qualifications, and Advancement

Telephone companies hire inexperienced men to train for jobs as linemen or cable splicers. Applicants for these jobs must have a high school or vocational school education and must pass a physical examination. Knowledge of the basic principles of electricity, and especially electronics, is helpful. Preemployment tests often are given to help determine the applicant's aptitudes. Some line and cable work is strenuous, requiring workers to climb poles and lift lines and equipment. Applicants for these positions must be physically qualified for such work. Manual dexterity and the ability to distinguish color also are important qualifications. Men who have received telephone training and experience in the armed services frequently are given preference for job openings and may be brought in above the entry level. For these jobs, telephone companies have training programs which include classroom instruction as well as on-the-job training. Classrooms are equipped with actual telephone apparatus, such as poles, cable supporting clamps, and other fixtures to simulate working conditions as closely as possible. Trainees learn to climb poles and are taught safe working practices to avoid contact with power wires and falls.

After a short period of classroom training, some trainees are assigned to a line crew to work on the job with experienced men under the supervision of a line foreman. About 6 years are required for linemen to reach the top pay for the job. Other trainees acquire the skills of the trade by working with experienced cable splicers to whom they are assigned.

Line construction craftsmen continue to receive training throughout their careers to qualify for more difficult assignments and to keep up with technological changes in the industry. Those having the necessary qualifications find many additional advancement opportunities in the telephone industry. For example, a lineman may be transferred to telephone installer and later to telephone repairman or other higher rated jobs.

Employment Outlook

Employment of linemen and cable splicers is expected to increase only at a slow rate, despite anticipation of a continuing high level of activity in line and cable installation, maintenance, and repair. However, hundreds of job openings for these craftsmen as a group are expected to become available during the 1970's because of the need to replace workers who transfer to other jobs, retire, or die.

Employment trends will differ among individual occupations. Only moderate growth is expected in the number of cable splicers because of technological developments that increase worker efficiency, such as devices that permit splicing of wires without the need to remove insulation; color code for identifying types wires in cables; and use of air pressured cables whose failure can be pinpointed by detecting devices. These developments, furthermore, are expected to reduce drastically the need for cable splicers' helpers, continuing the rapid decline in employment in this occupation in recent years. Little or no change is expected in the number of linemen because of the increasing use of mechanical improvements, such as trucks with derricks and pole-lifting equipment, earth-boring tools, lightweight ladders, and "skybuckets," which have eliminated much of the physical work of the line crews, and is causing a substantial reduction in the regular size of a line crew.

Earnings and Working Conditions

Cable splicers have higher earnings than linemen. In December 1969 in the United States as a whole, cable splicer's basic rates averaged $3.77 an hour, and linemen's rates averaged $3.07. Average hourly rates ranged from $3.43 to $4.02 for cable splicers and from $2.51 to $3.33 for linemen, with variations in earnings depending on locality.

Pay rates within the jobs also depend to a considerable extent upon length of service. For example, according to a 1970 union-management agreement, new workers in line construction jobs in one of the higher pay scale cities begin at $105.50 for a 40-hour week. Linemen can reach the maximum of $190 after 6 years service. The maximum basic weekly rate for cable splicers is $193 based upon a combined total of at least 6 years of work in a plant craft job, as a helper and as a splicer, or in related craft jobs. Linemen and cable splicers are covered by the same contract provisions governing overtime pay, vacations, holidays, length of service, and other benefits that apply to telephone workers generally. (See discussion earlier in this chapter.)

Linemen and cable splicers work outdoors. They must do a considerable amount of climbing. They also work in manholes, often in stooped and cramped positions. Safety standards, developed over the years by telephone companies with the cooperation of labor unions, have greatly reduced the hazards of these occupations. When severe weather conditions damage telephone lines, linemen and cable splicers may be called upon to work long and irregular hours to repair damaged cable facilities and to restore service. Because of the nature of their work, some linemen and cable splicers, by the time they reach their midfifties, transfer to other jobs such as installers and repairmen or central office craftsmen.

TELEPHONE AND PBX INSTALLERS AND REPAIRMEN

Nature of the Work

Telephone and private branch exchange (PBX) installers and repairmen (sometimes called servicemen) install and service telephone and PBX systems on the customers' property and make necessary repairs on the equipment when trouble develops. These workers travel to customers' homes and offices in trucks equipped with telephone tools and supplies. When telephone customers move or request new types of service, installers relocate telephones or make changes on customers' existing equipment. For example, they may install a PBX system in an office or change a two-party line to a single-party line in a residence. Installers also may fill a customer's request to add an extension in another room or to replace an old telephone with a newer model.

Telephone and PBX installers and repairmen are the largest group of telephone craftsmen; about 102,000 were employed in 1970. Most of these men mainly install telephones or private branch exchanges, and about 23,000 repair and maintain this equipment. The jobs of installing and repairing telephones and PBX systems are discussed below as separate jobs, but many telephone companies combine two or more of these jobs.

Telephone installers (D.O.T. 822.381) install and remove telephones in homes and places of business. They connect newly installed telephones to outside service wires which are on nearby buildings or poles. Installers often must climb poles to make these connections. Telephone installers are sometimes called *station installers*.

PBX installer tests PBX equipment.

PBX installers (D.O.T. 822.381) perform the same duties as telephone installers, but they specialize in more complex switchboard installations. They connect wires from terminals to switchboards and make tests to check their installations. Some PBX installers also set up equipment for radio and television broadcasts, mobile radiotelephones, and teletypewriters.

Telephone repairmen (D.O.T. 822.281), with the assistance of testboardmen in the central office, locate trouble on customers' equipment and make repairs to restore service. Sometimes the jobs of telephone repairmen and telephone installers are combined and the workers are called *telephone installer-repairmen*.

PBX repairmen (D.O.T. 822.281), with the assistance of testboardmen, locate trouble on customers' PBX systems and make the necessary repairs. They also maintain associated equipment such as batteries, relays, and power plants. Some PBX repairmen maintain and repair equipment for radio and television broadcasts, mobile radiotelephones, and teletypewriters. Sometimes the jobs of PBX installers and PBX repairmen are combined into the job of PBX *installer-repairmen*.

Training, Other Qualifications, and Advancement

Telephone companies train experienced men for telephone and PBX installation and repair jobs. Since much of the work requires personal contact with customers, applicants who have a pleasing appearance and the ability to deal effectively with people are preferred. Applicants for these skilled jobs must have a high school or vocational school education. Preemployment tests usually are given to help determine an applicant's aptitude for mechanics and reading diagrams and blueprints. Installers and repairmen should have manual dexterity, good eyesight (corrected), and telephone and PBX installers and repairmen should be able to adapt to the changes brought about by new communications technology.

New workers are given on-the-job training and instruction in classrooms equipped with telephone poles, lines and cables, and terminal boxes, as well as models of typical residential construction to simulate actual working conditions. Trainees practice installing telephones and making connections to service wires just as they would in the field. After a few weeks of such training, new workers continue to learn by watching and helping experienced men on the job.

Telephone and PBX installers

and repairmen continue to receive training throughout their careers to qualify for more responsible work and to keep up with technological changes. A new worker may start as lineman, move to telephone installer or repairman, and later advance to either PBX installer or repairman.

Employment Outlook

Employment of telephone and PBX installers and repairmen is expected to increase very rapidly through the 1970's due to a growing demand for more telephones, and PBX and CENTREX systems. Many opportunities will also result from the need to replace workers who transfer to other telephone jobs, leave the industry, retire, or die. Some job openings may be filled by workers transferring from other telephone craft jobs, such as linemen and cable splicers, but many will be open to new entrants to the labor force.

Expansion is anticipated in the volume of service handled by telephone and PBX installers and repairmen because of the expanding number of telephones to be serviced and repaired and the increased use of specialized types of phone equipment, as well as, the development of improved but more complex equipment. Technological changes which have increased the efficiency of individual installers or repairmen will limit the employment increase. Examples of such changes include improved designs for telephone instruments, wires, and cables, and the development of removable components which can be returned to factory or service shop for repair.

Earnings and Working Conditions

In December 1969 the average basic hourly rate for PBX repairmen was $3.96 and the rate for telephone and PBX installers was $3.62.

The effect of length of service on wage rates is illustrated by a 1970 union–management agreement in one of the higher pay scale cities. Under this agreement, telephone installers and repairmen have a starting rate of $105.50 for a 40-hour week, with periodic pay increases until a maximum of $190 a week is reached after about 6 years. Installers and repairmen are covered by the same provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally. (See discussion earlier in this chapter.)

Telephone and PBX installers and repairmen work indoors and outdoors in all kinds of weather. Outdoor work includes climbing poles to place and repair telephone wires leading from poles to customers' premises. Installers and repairmen may work extra hours when breakdowns occur in lines or equipment.

OCCUPATIONS IN THE TRUCKING INDUSTRY

In 1970, the trucking industry employed approximately 1 million workers—more than the rail, air, and pipeline transportation industries combined. The industry furnishes many jobs for young persons who do not plan to attend college. Nearly 90 percent of its employees handle freight, drive or maintain trucks, and do clerical or other work that requires no more than a high school education.

Nature and Location of the Industry

The trucking industry is made up of firms that furnish local and long-distance hauling and storage on a for-hire basis. Trucking terminals located in various cities for the distribution and pickup of freight and the maintenance of trucking equipment also are part of the industry.

Local trucking companies serve a single city and its suburbs. All others are long-distance carriers and usually travel through many States. Some firms specialize in the type of goods carried, for example, they may carry oil, grain, livestock, automobiles, or furniture that usually require special truck rigging and loading and unloading equipment. Trucking companies operate as either contract or common carriers. Contract carriers haul commodities of one or a few shippers exclusively; common carriers serve the general public.

The industry's employment is concentrated in a relatively small number of large companies. Fewer than 10 percent of the trucking companies in interstate commerce have annual revenues of $1 million or more, but account for almost half of the employment. However, a large proportion of the companies are small, particularly those which serve a single city. Many are owner-operated, and the owner does the driving.

Trucking industry employees work in cities and towns of all sizes and are distributed much the same as the Nation's population. About half of them work in seven States: California, New York, Illinois, Pennsylvania, Ohio, Texas, and New Jersey. Chicago, Los Angeles, and New York are the hubs of the Nation's trucking networks.

Occupations in the Industry

About three-fourths of all trucking industry employees have blue-collar jobs. Included in this occupational group are about 580,000 truckdrivers, who represent over half the industry's total employment. About 10 percent are material handlers. Other important blue-collar occupations are mechanics, washers and lubricators, and foremen. Most white-collar employees are clerical workers, such as secretaries and rate clerks, and administrative personnel, such as terminal managers and accountants.

Men hold 9 out of every 10 jobs in the industry. Nearly all women employees are clerical workers.

The duties and training requirements of some of the important occupations are described briefly in the following sections. Detailed discussions of many of these occupations are given elsewhere in the *Handbook* under individual occupations.

Truckdriving Occupations. More than half of the industry's employees are truckdrivers. *Over-the-road drivers* (D.O.T. 904.883) operate large tractor-trailers or single unit trucks long distances, and spend nearly all of their working hours behind the wheel. They transport goods of great value which must be delivered safely and on time. Some drivers load and unload

their trucks, but usually other employees do this work.

Local drivers (D.O.T. 906.883) operate trucks over short distances, usually within a city and its suburbs. They deliver goods from trucking terminals to wholesalers, retailers, and other businesses in the area. They also pick up goods for delivery to terminals where loads are made up for long trips.

Clerical occupations. About 1 out of every 7 of the industry's employees is a clerical worker. Many have general clerical jobs, such as secretary or clerk-typist, which are common to all industries. Others have specialized jobs. For example, *dispatchers* (D.O.T. 919.168) coordinate the movement of trucks and freight into and out of terminals; make up loads for specific destinations; assign drivers and develop delivery schedules; handle customers' requests for pickup of freight; and provide information on deliveries. *Rate clerks* (D.O.T. 219.388) calculate shipping charges according to tariff regulations. *Claims clerks* (D.O.T. 241.368) handle claims for freight lost or damaged during transit. *Manifest clerks* (D.O.T. 222.488) prepare forms that list details of freight shipments. *Parts-order clerks* (D.O.T. 223.389) supply mechanics with replacement parts for trucks; they also take care of most of the clerical duties necessary for maintaining a truck repair shop.

Administrative and Related Occupations. More than 1 out of 10 employees is an administrator. Top executives manage companies and make policy decisions. Middle managers supervise the operation of individual departments, terminals, or warehouses. A small number of accountants and lawyers are in staff positions. The industry also employs sales representatives to solicit freight business.

Material Handling Occupations. About 1 out of 10 employees moves materials into and out of trucks and warehouses. Much of this work is done by *material handlers* (D.O.T. 909.887) who work in gangs of three or four under the supervision of a dock foreman or gang leader. Material handlers load and unload freight with the aid of handtrucks, conveyors, and other devices. Heavy items are moved by *power truck operators* (D.O.T. 922.883) and *crane operators* (D.O.T. 921.280). Gang leaders determine the order in which items will be loaded so that the cargo is balanced and items to be unloaded first are near the back of the truck. *Truckdrivers' helpers* (D.O.T. 905.887) travel with drivers to unload and pick up freight. Occasionally, helpers may do relief driving.

Truck Maintenance Occupations. About 1 out of every 20 employees maintains the industry's operating equipment. *Truck mechanics* (D.O.T. 620.281) keep trucks and trailers in good running condition. Much time is spent in preventive maintenance to assure safe operation, to check wear and damage to parts, and to reduce breakdowns. When breakdowns do occur, they determine the cause and make the necessary repairs. *Truck mechanic helpers* (D.O.T. 620.884) and apprentices assist experienced mechanics in inspection and repair work. *Lubrication men* and *washers* (D.O.T. 915.887 and 919.887) clean, lubricate, and refuel trucks, change tires, and do other routine maintenance.

Training, Other Qualifications, and Advancement

New workers in blue-collar occupations usually are hired at the unskilled level, as material handlers, truck drivers' helpers, or lubrication men and washers. No formal training is required for these jobs, but many employers prefer high school graduates. Applicants must be in good physical condition. New employees work under the guidance of experienced workers and foremen while learning their jobs, which usually takes no more than a few weeks. As vacancies occur, they advance to higher rated blue-collar jobs, such as power truck operators and truckdrivers. Qualifications for promotion are the ability to do the job and length of service with the firm. Material handlers who demonstrate supervisory ability can become gang leaders or dock foremen.

Qualifications for truckdriving jobs vary and depend on individual employers, the type of truck, and other factors. Every driver must have a chauffeur's license, a commercial driving permit obtained from State Motor Vehicle Departments. The U.S. Department of Transportation establishes minimum qualifications for over-the-road drivers. The driver must be at least 21 years old, able-bodied, have good hearing, and vision of at least 20/40 with or without glasses. He also must be able to read and speak English and have at least 1 year of driving experience and a good driving record. Many firms will not hire over-the-road drivers under 25; they also may specify limitations on height and weight.

Young persons interested in professional driving should take the driver-training courses offered by many high schools. A course in automotive mechanics is also helpful because it provides a knowledge of the mechanical operations of a truck. Private truckdriving training schools offer another opportunity to prepare for a driving job. However, completion of such a course does not assure immediate employment as a driver. Graduates frequently must start as material handlers or drivers' helpers and advance to driving jobs. Prospective students should enroll only in truckdriving courses offered by schools which have been certified by the State.

Most truck mechanics learn their skills informally on-the-job as helpers to experienced mechanics. Others complete formal apprenticeship programs which generally last 4 years and include on-the-job training and related classroom instruction. Unskilled workers, such as lubrication men and washers, frequently are promoted to helpers and apprentices. However, many firms will hire inexperienced young people for helper or apprentice jobs, especially those who have completed courses in automotive mechanics.

Completion of commercial courses in high school or business school is uaually adequate for entry into general clerical occupations, such as secretary or typist. Additional on-the-job training is needed for specialized clerical occupations, such as rate or claims clerk.

Generally, no specialized education is necessary for dispatcher jobs. Openings are filled by truck drivers, rate clerks, or other workers who know their company's operations and are familiar with State and Federal driving regulations. A candidate may improve his qualifications by taking college or technical school courses in transportation.

Administrative and sales positions frequently are filled by college graduates who have majored in business administration, marketing, accounting, industrial relations, or transportation. Some companies have management training programs for college graduates in which trainees work for brief periods in various departments to get a broad picture of trucking operations before they are assigned to a particular department. High school graduates may be promoted to administrative and sales positions.

Employment Outlook

Employment in the trucking industry is expected to grow rapidly through the 1970's. New jobs resulting from employment growth, as well as jobs that must be filled as experienced workers retire, die, or transfer to other fields are expected to account for tens of thousands of openings each year.

Demand for trucking is expected to rise very rapidly in response to general economic growth. Also significant are additional segments of the national interstate and defense highway systems to be completed over the next decade. These roads have more lanes, fewer curves and other improvements which have resulted in reduction of State limitations of truck weight, size, and speed. In addition, many new factories and other businesses are located in suburban or rural areas where rail facilities are extremely limited or nonexistent.

Employment will not increase as fast as demand for trucking because technological developments and a continued trend to larger, more efficient firms will increase output per worker. As a result of these developments, rates of growth will vary among occupations. Employment of material handlers, for example, is expected to increase slowly because of more efficient freight handling methods—such as conveyors and draglines to move freight in and out of terminals and warehouses, and cargo cages to combine less-than-truckload shipments. In contrast, employment of truckdrivers is expected to increase rapidly, although improved highways and vehicles will result in bigger loads at higher speeds and fewer drivers will be required for each ton of freight.

Compared with small organizations, large companies have higher proportions of accountants, personnel workers, clerks, sales workers, truck mechanics, and foremen. Employment in most of these occupations is expected to increase very rapidly as a result of the trend to larger trucking companies. On the other hand, terminal managers make up a greater proportion of employment in small firms, since they perform many of the tasks that are assigned to other workers in large organizations. Thus, the demand for terminal managers will grow slowly as employment becomes more concentrated in large firms.

Earnings and Working Conditions

In 1970, nonsupervisory workers in the trucking industry averaged \$169.32 a week or \$4.08 an hour compared with \$121.73 a week or \$3.29 an hour for nonsupervisory workers in all private nonagricultural industries. Earnings are relatively high in the trucking industry because drivers represent a large proportion of employment; many over-the-road drivers earn more than \$200 a week.

Most employees are paid an hourly rate or a weekly or monthly salary. However, truckdrivers on the longer runs generally are paid on a mileage basis for driving time. For all other work time, they are paid an hourly rate. Most employees receive premium pay for overtime, Sundays, and holidays.

Paid vacations are almost universal in the trucking industry. Typically, employees receive a 1 week vacation after 1 year of service, 2 weeks after 3 years, 3 weeks after 10 years, and 4 weeks after 15 years. Nearly all workers receive paid holidays. Insurance and pension plans, financed at least partially by employers, cover most workers, and include life, sickness, hospitalization, and surgical insurance.

Working conditions vary greatly among occupations in the industry. Truckdriving is both physically and mentally demanding, but conditions have improved as a result of better highways, more comfortable seating, power steering, and air-conditioned cabs. Over-the-road drivers frequently work at night and spend time away from home. Local drivers usually work only during the day. Material handlers and truckdriver's helpers have strenuous jobs. In recent years, conveyor systems, motorized hand trucks, power tail gates, and other freight handling equipment have reduced some of the heavier lifting and made the work safer. Although their duties are not physically strenuous, truck mechanics and other maintenance personnel may have to work in awkward or cramped positions while servicing vehicles. Most maintenance shops are well lighted, heated, and ventilated. Mechanics occasionally make repairs outdoors where breakdowns occur. Many large organizations operate around the clock and require some material handling and maintenance personnel to work evenings and nights.

A large number of trucking industry employees are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.)

Sources of Additional Information

Information on career opportunities may be obtained from:

American Trucking Association,
1616 P St., NW., Washington,
D.C. 20036.

WHOLESALE AND RETAIL TRADE

Wholesaling and retailing are the final stages in the process of transferring goods from producers to consumers. Wholesalers assemble goods in large lots and distribute them to retail stores, industrial firms, and institutions such as schools and hospitals. Retailers sell goods directly to housewives and other consumers in a variety of ways—in stores, by mail, or through door-to-door selling. A list of the items sold by wholesale and retail businesses would include almost every item produced by American industry—automobiles, clothing, food, furniture, and countless others.

In 1970, nearly 15 million persons (not counting an estimated 2 million self-employed and unpaid family workers) worked in wholesale and retail trade. Retail trade accounted for the largest number of workers—11.1 million—or about three-fourths of the employment in the broad industry group. The majority of these workers are employed in department stores, in food stores, and in restaurants and other eating places. About 3.8 million persons worked in wholesale trade.

Wholesale and retail businesses are a major source of job opportunities for women. In 1970, for example, nearly one-half of the workers employed in retail trade were women. They represented about one-fifth of all workers employed in wholesale trade. Many of the women employed in retail stores work part time.

Workers with a wide range of education, training, skill, and ability are employed in wholesale and retail trade. In 1970, white-collar workers accounted for more than 3 out of 5 persons employed in the major industry group, as shown in the accompanying table. Sales workers, the largest single group, make up nearly one-fourth of total industry employment. Managers and proprietors, the second largest group of workers, account for about one-fifth of the industry's work force. Many managers and proprietors own and operate small wholesale houses or retail businesses such as food stores and gasoline service stations. Clerical workers account for roughly one-sixth of the work force; many are employed by retail stores as cashiers, especially in supermarkets and other food stores. Other important clerical occupations in retail trade include secretaries, stenographers and typists, office machine operators, and bookkeepers and accounting clerks. Large numbers of shipping and receiving clerks are employed in both wholesale and retail trade.

Blue-collar workers (craftsmen, operatives, and laborers) accounted for nearly one-fourth of all employment in the industry group in 1970. Many are employed as mechanics and repairmen, gasoline service station attendants, drivers and deliverymen, meat cutters, and materials handlers. Most mechanics work for motor vehicle dealers and gasoline service stations. A large number of meat cutters are employed in wholesale grocery establishments and in supermarkets and other food stores.

Service workers, employed mostly in retail trade, accounted for roughly 1 out of 7 workers in the industry group. Food service workers, such as waitresses and cooks, made up by far the largest concentration of service workers. Other large groups of service workers were janitors, charwomen and cleaners, and guards and watchmen.

Major occupational group	*Estimated employment, 1970 (percent distribution)*
All occupational groups	100
Professional, technical, and kindred workers	2
Managers, officials, and proprietors	21
Clerical and kindred workers	17
Sales workers	23
Craftsmen, foremen, and kindred workers	7
Operatives and kindred workers	11
Service workers	14
Laborers	5

NOTE: Due to rounding sum of individual items may not equal total.

Employment in wholesale and retail trade is expected to increase moderately through the 1970's. The major factors contributing to the expected growth of employment are increasing population and consumer expenditures, continuation of the population movement from rural to urban areas and from city to suburbs, and the trend toward keeping stores open longer hours. Growth in employment requirements is expected to be slowed somewhat by the increasing applications of labor-saving technology. For example, technological change may effect employment because of improvements in materials-handling methods, packaging innovations, the growing use of computers for inventory control and billing operations, the increasing use of mechanized equipment in supermarkets, and the continued growth in the number of stores using self-service operations.

Within retail trade, employment in department stores, drug stores, restaurants, auto dealerships, and service stations is expected to rise fastest. Among wholesale establishments, the rates of employment growth are likely to be highest in businesses that distribute auto parts, and in firms selling industrial machinery, equipment, and supplies.

The statement that follows covers the major occupations in restaurants, where, for example, large numbers of waiters and waitresses, and cooks and chefs are employed. More detailed information about occupations that cut across many industries appears elsewhere in the *Handbook*. These include salesmen, office workers, shipping and receiving clerks, maintenance trades, and many others. (See index in the back of the book.)

RESTAURANT INDUSTRY

In 1970, about 2.5 million people were employed in establishments whose main business was serving food and beverages. Many other food-service workers were employed in establishments that serve meals in connection with some other activity—for example, drug and department stores, hotels, hospitals, school and college lunchrooms, and factory cafeterias. Commercial airlines, railroads, and shiplines also employ food-service workers.

Nature and Location of the Industry

Establishments catering to the custom of "eating out" range from small diners to luxurious and expensive restaurants. The kind of food offered and the way it is served depend upon the size, location, and financing of the restaurant, as well as the type of customer it seeks to attract. For example, cafeterias located in office buildings, factories, or suburban shopping centers emphasize rapid service and inexpensive meals. In contrast, some restaurants cater to customers who have the time to eat in a leisurely manner and, thus, they serve elaborate meals which may include unusual dishes or "specialties of the house."

Most restaurants are small and have fewer than 10 paid employees; many of these are operated by their owners who have no paid help or have only 1 or 2 part-time workers. An increasing proportion of all restaurants are run by firms owning more than one restaurant.

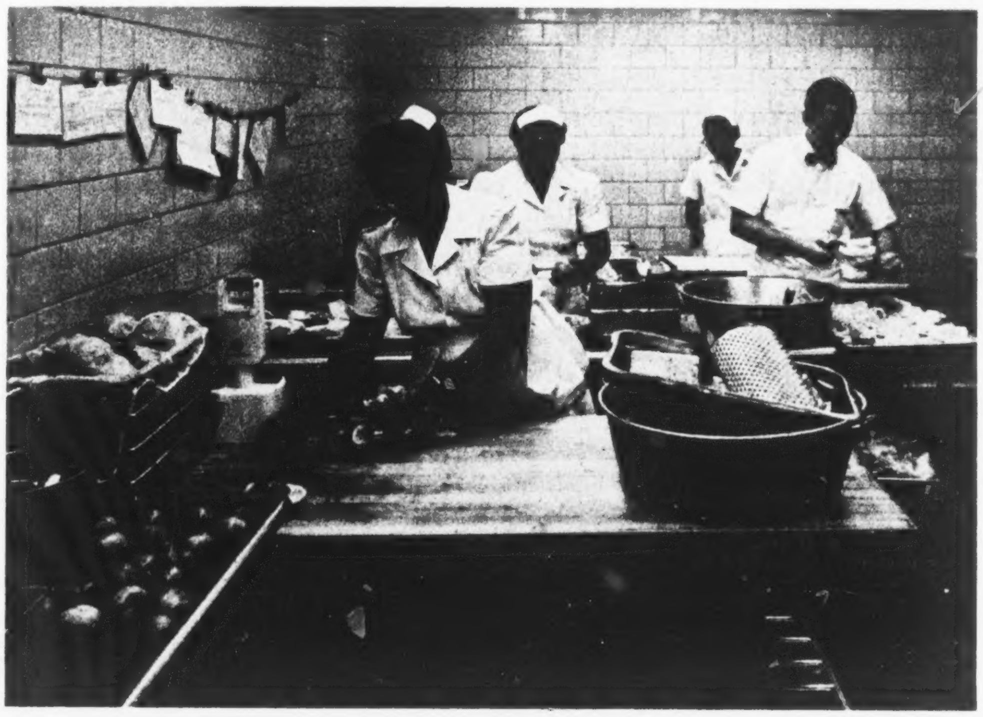
Although restaurant employment is concentrated in the States with the largest populations, and particularly in large cities, even very small communities have luncheonettes and roadside diners.

Restaurant Workers

About three-fourths of all restaurant employees prepare and serve food or do other kinds of related service work. The two largest occupations in this group are waiters and waitresses, and cooks and chefs. Also included are counter attendants who serve food to customers in cafeterias; bartenders who mix and serve drinks to customers; busboys and busgirls who clear tables, carry soiled dishes back to the kitchen, and sometimes set tables; kitchen workers who wash dishes and prepare vegetables; pantrymen and pantrywomen who prepare salads and certain other dishes; and janitors and porters who dispose of trash and garbage, sweep and mop floors, and do other cleaning jobs. Some of these workers operate mechanical equipment such as power-driven dishwashers, floor polishers, vegetable slicers and peelers, and garbage disposal equipment. These specialized service jobs, however, are likely to be found only in the largest restaurants. In many small eating places, waiters and waitresses clear and set up tables, sometimes prepare certain kinds of dishes, and help in the kitchen when they are not busy with customers. (Detailed information on cooks and chefs, waiters and waitresses, and bartenders is given elsewhere in the *Handbook*. See index for page numbers.)

Another large group of restaurant workers—about one-sixth of the total—are managers and proprietors. Many are owners and operators of small restaurants and, in addition to acting as managers, may do cooking and other work. Some are salaried employees managing restaurants for others.

All other restaurant workers combined account for less than one-tenth of total industry employment. They are employed principally in large restaurants. Most are



clerical employees—cashiers who receive payments and make change for customers; food checkers who total the cost of the meals selected by cafeteria customers; and bookkeepers, stenographers, typists, and other office workers. Dietitians plan menus, supervise the preparation of meals, and enforce sanitary regulations. Some large restaurants also employ mechanics and other maintenance workers, accountants, advertising or public relations directors, personnel workers, and musicians or other entertainers.

Training, Other Qualifications, and Advancement

Experience and skill requirements for workers employed in restaurants vary widely and depend on the particular occupation and type and size of the restaurant. For example, employees in inexpensive diners and luncheonettes generally require less training than those employed in expensive restaurants.

Entry requirements for some restaurant jobs are minimal. Young people who have less than a high school education and no previous experience often can qualify for employment as kitchen workers, dishwashers, or busboys. Previous experience, and in some cases special training, may be required for cooks and chefs, waiters and waitresses, and other occupations.

Newly hired restaurant workers receive on-the-job training. A kitchen worker, for example, may learn how to operate a dishwasher or other mechanical kitchen equipment. Waiters and waitresses may be taught how to set tables, take orders from customers, and how to serve food in a courteous and efficient manner. In a great many small restaurants, new employees receive their training under the close supervision of an experienced employee or the proprietor. In larger restaurants and some chain restaurant operations, training programs are likely to be more formal, and beginners may be required to attend training sessions for a few days or longer.

Many vocational schools—both public and private—provide training that is helpful to persons interested in restaurant work. Vocational education programs provide courses in food preparation and cooking, catering, restaurant management, and related subjects. Similar training programs for a variety of restaurant occupations, ranging from a few months to 2-years or more in length, are available through restaurant associations and trade unions, technical schools, junior and community colleges, and 4-year colleges. Many young people, for example, prepare for supervisory jobs by completing 2 year programs in food service management offered by junior and community colleges located throughout the country.

Classroom and on-the-job training programs for unemployed and underemployed workers seeking employment in restaurants are in operation in a large number of cities under the Manpower Development and Training Act (MDTA). Training under the MDTA is provided for cooks and cook apprentices, waiters and waitresses, food service supervisors, and cook helpers. These programs last approximately 12 to 15 weeks.

Handicapped workers are being trained in a number of programs for employment in restaurants. Recent projects have resulted in the employment of many mentally retarded persons in occupations such as dishwasher and kitchen helper.

Employers look for applicants who have good health and physical stamina because restaurant workers are required to work long hours—often under considerable pressure. Neatness, a pleasant manner, and an even disposition also are important, particularly for waiters and waitresses and other employees who deal with the public.

Restaurants, particularly large chain operations, offer promotion opportunities to workers having initiative and ability. A young person who begins as a busboy or dishwasher can be promoted to a better paying job such as waiter or cook's helper. Through additional training, he can advance to cook or chef, baker, or bartender. A restaurant hostess may work her way up to assistant manager. Experience as a maitre d' hotel may lead to a position as director of food and beverage services in a large chain organization. Assistant managers, particularly those with college training, may be promoted to manager and eventually managing director.

Employment Outlook

Employment in the restaurant industry is expected to rise rapidly through the 1970's as the volume of restaurant business increases. In addition to job openings created by employment growth, an even greater number will result from turnover. Most openings will be for waitresses and kitchen helpers—both because of high turnover and because these workers make up a very large proportion of all restaurant employees. Employment opportunities also are expected to be favorable for skilled cooks and salaried restaurant managers. The number of openings in clerical jobs, such as cashier and bookkeeper, will be relatively small. A few openings will occur in specialized positions, such as food manager and dietitian.

A growing population, increasing leisure time, and higher income levels will raise the demand for restaurant services. More people will "eat out" as large numbers of housewives take outside employment and more people travel. However, employment will not increase as rapidly as the demand for restaurant services because worker productivity is rising. Restaurants—particularly those serving hundreds of meals daily—have increased the efficiency of their operations in recent years, as managers have centralized the purchase of food supplies, introduced self-service and used precut meats and modern equipment. Further improvements of this kind are expected during the 1970's.

Earnings and Working Conditions

The location, size, and type of restaurant affect earnings of restaurant workers. Other significant factors include the tipping practice for some occupations and the degree of unionization.

In 1970, average earnings of nonsupervisory employees in the restaurant industry (excluding tips) were $57.72 a week or $1.85 an hour for a 31.2-hour workweek, compared with $82.47 a week or $2.44 an hour for a 33.8-hour workweek for workers in all retail trade establishments.

Limited data from union-management contracts in effect in 1970, covering eating and drinking places in several large cities, indicate straight-time hourly pay rates for various types of restaurant workers ranged as follows:

Waiters and waitresses	$0.82–$2.15
Busboys and busgirls	1.01– 2.26
Dishwashers	1.32– 2.60
Pantry workers	1.46– 3.33
Assistant cooks	1.47– 3.86
Porters	1.48– 2.60
Kitchen helpers	1.53– 3.20
Cashiers	1.57– 2.47
Checkers	1.57– 2.73
Cooks	2.02– 4.12
Bartenders	2.09– 3.87
Chefs	2.22– 4.65

Salaries of managerial employees have a wide range, mainly because of differences in duties and responsibilities. Many college graduates who have specialized training in restaurant management received starting salaries ranging from $7,000 to $10,000 annually in 1970. Managerial trainees without this background often started at lower salaries. Many experienced restaurant managers receive salaries between $10,000 and $25,000 a year, depending on size, location, and type of restaurant. Salaries below this range may be paid to managers of small restaurants.

In addition to wages, restaurant employees usually receive at least one free meal a day and often are provided with uniforms. Waiters, waitresses, and bartenders also receive tips. Paid vacations and holidays are common, and various types of health and insurance programs also are available. Most full-time restaurant workers have work schedules of 40 to 48 hours a week. Many work on split shifts, which means they are on duty for several hours during one meal, take some time off, and then return to work during the next period of heavy activity. Scheduled hours may include work in the late evenings and on holidays and weekends.

Many restaurants are air-conditioned, have convenient work areas, and are furnished with the latest equipment and laborsaving devices. In other restaurants—particularly small ones—working conditions may be less desirable. In all restaurants, workers spend long periods on their feet, may be required to lift heavy trays and other objects, or work near hot ovens or steam tables. Work hazards include the possibility of burns; injury from knives, broken glass or china, or mechanical equipment; and slips and falls on wet floors.

The principal union in the restaurant industry is the Hotel & Restaurant Employees and Bartenders International Union (AFL–CIO). The proportion of workers covered by union contracts varies greatly from city to city.

Sources of Additional Information

Additional information about careers in the restaurant industry may be obtained from:

Educational Director, National Restaurant Association, 1530 North Lake Shore Dr., Chicago, Ill. 60610.

A list of public and private schools and colleges offering courses which train restaurant employees may be obtained from:

Council on Hotel, Restaurant and Institutional Education, 1522 K Street, NW., Washington, D.C. 20005.

Information on courses relating to restaurant work may be obtained from the local Director of Vocational Education, the Superintendent of Schools in the local community, or the State Director of Vocational Education in the Department of Education in the State capital.

FINANCE, INSURANCE, AND REAL ESTATE

Nearly every individual or organization uses the diverse and complex services provided by the finance, insurance, and real estate industry. Financial institutions—banks, savings and loan associations, consumer credit organizations, and others—make banking and credit facilities available to individuals and businesses. The types of services they offer range from providing simple financial services such as personal checking and savings accounts to acting as the broker and salesman in the buying and selling of stocks and bonds needed by giant corporations for investment capital. Insurance firms provide protection against losses due to fire, accident, sickness, death, and many other contingencies. Real estate organizations act as intermediaries in the sale of houses, buildings, and other property, and often manage large office and apartment buildings.

In 1970, nearly 3.7 million workers were employed in the finance, insurance, and real estate industry. Finance, employing 1.6 million persons, made up the largest sector. The next largest concentration of employment was in insurance where over 1.3 million workers were employed. The remaining workers—about one-sixth of the total—were employed in real estate.

Finance, insurance, and real estate firms are a major source of job opportunities for women, who made up over half of the industry's work force in 1970. Their proportion ranged from about 35 percent in real estate to over 60 percent in banking.

As shown in the accompanying tabulation, 93 percent of the workers in the industry held white-collar jobs in 1970. Clerical workers alone made up 48 percent of the industry's work force. Many clerical workers were employed in specialized banking and insurance occupations such as bankteller, checksorter, and insurance claim adjuster. Other large clerical occupations include stenographer, typist, secretary, and office machine operator—occupations also found in most other industries. Sales workers constituted 17 percent of the work force. Most of them were insurance and real estate agents and brokers. A relatively small number of the sales workers sold stocks and bonds.

Managers and officials—bank officials, office managers, and others—made up 23 percent of the industry's work force in 1970. Professional and technical workers, such as accountants, programmers, and business research analysts, accounted for 5 percent of the work force. Most of them were employed by financial institutions.

Employment in the finance, insurance, and real estate industry is expected to increase moderately through the 1970's as a result of population growth, increasing business activity, and rising personal incomes. However, increasing use of computers for routine clerical and recordkeeping functions may limit employment growth to some extent. Employment is expected to increase more rapidly in the financial sector than in insurance and real estate.

Major occupational group	*Estimated employment, 1970 (percent distribution)*
All occupational groups	100
Professional, technical, and kindred workers	5
Managers, officials, and proprietors	23
Clerical and kindred workers	48
Sales workers	17
Craftsmen, foremen, and kindred workers	3
Operatives and kindred workers	(1)
Service workers	4
Laborers	1

(1) Less than 0.5 percent.

NOTE: Due to rounding sum of individual items may not equal total.

In addition to job openings from employment growth, many thousands of openings will result as women leave work to assume family responsibilities. Replacements also will be needed to fill vacancies created by deaths and retirements and by transfers of workers out of the industry.

The statements that follow cover major occupations in the banking and insurance fields. More detailed information about occupations that exist in many industries appears elsewhere in the *Handbook*. (See index in the back of the book.)

OCCUPATIONS IN BANKING

Banks have been described as "department stores of finance" because of the variety of services they offer. Their services range from individual checking accounts to letters of credit to finance world trade. They safeguard money and valuables; administer trusts and personal estates; and lend money to business, educational, religious and other organizations. Banks also lend money for the purchase of homes, automobiles, and household items, and to cover unexpected financial needs. Banks continually strive to serve their customers' needs. In recent years, for example, they have offered revolving check credit plans, charge cards, travel services, accounting and billing services, and money management counseling. Facilities to handle charge accounts in retail stores, and convenient "drive-up" windows also are available.

Banks and Their Workers

Banks employed more than a million workers in 1970; about two-thirds were women. Most of these bank employees work in commercial banks, where a wide variety of services are offered. Other bank employees work in mutual savings banks, which offer a more limited range of services—mainly savings deposit accounts, mortgage loans, safe-deposit rentals, trust management, money orders, travelers checks, and passbook loans. Still others work in the 12 Federal Reserve Banks (or "bankers' banks") and their 24 branches; and in foreign exchange firms, clearing house associations, check cashing agencies, and other organizations doing work closely related to banking.

In addition, many people are employed by savings and loan associations, personal credit institutions, and related institutions.

In 1970, commercial banks processed more than 20 billion checks and handled an enormous amount of paperwork. Clerks who do this work account for nearly two-thirds of all employees. Many of these workers are tellers or clerks who process the thousands of deposit slips, checks, and other documents which banks handle daily. Banks also employ many secretaries, stenographers, typists, telephone operators, and receptionists.

Bank officers are the second largest group in the industry. Approximately 1 out of 5 employees is an officer—a president, vice president, treasurer, comptroller, or other official. Much smaller occupations include accountants, lawyers, personnel directors, marketing and public relations workers, statisticians, economists, and other professional workers, as well as guards, elevator operators, cleaners, and other service workers.

This chapter describes three large occupations unique to banking—clerks, tellers, and officers.

Places of Employment

In 1970, there were more than 35,000 commercial banks and branch banks and more than 1,400 mutual savings banks and branches. Bank employment is concentrated, to a considerable extent in a relatively small number of very large banks and their branches. Thus, in 1969, the 500 largest commercial banks in the country, each having total deposits of $100 million or more, employed more than one-half of all commercial bank employees, whereas over 8,000 small commercial banks (having total deposits of $10 million or less) employed only about 10 percent of all commercial bank workers.

Bank employees work mainly in heavily populated areas. Approximately half of all bank employees are located in New York, California, Illinois, Pennsylvania, and Texas. New York City, the financial capital of the Nation, has far more bank employees than any other city.

Training

Professional and managerial bank personnel usually have completed college; most clerks have completed high school; guards and building service personnel may have less than a high school education.

Most new employees undergo some form of in-service training regarding bank policies and procedures. Banks also provide other numerous opportunities for workers to broaden their knowledge and skills. Additional information about the educational requirements which apply to bank clerks, tellers, and bank officers, and the training given them, is provided in the statements that follow.

Many banks encourage employees to take courses at local colleges and universities. In addition, banking associations sponsor a number of educational programs, sometimes in cooperation with colleges and universities. Many banks pay all or part of the costs for those who successfully complete courses.

Bank employees can also prepare for better jobs by enrolling in courses offered by the American Institute of Banking in many cities throughout the country. The Institute, which has 375 chapters and 162 study groups, also offers correspondence study for bank employees. The Institute offers a broad range of courses and assists local banks in conducting cooperative training programs for various bank positions.

Bank employees should enjoy working with numbers. They also must be able to accept the responsibility of handling large amounts of money. They should present a good image to customers; often they are encouraged to participate in community activities.

Employment Outlook

Employment in banks is expected to rise moderately through the 1970's. New jobs resulting from employment growth, as well as jobs that must be filled as employees retire, die, or stop working for other reasons are expected to account for tens of thousands of jobs each year. Still other openings will occur as employees leave their positions to enter other types of employment.

Most openings will be for clerks. In addition, an increasing number of trainee jobs, which may lead to officer positions, will probably become available for college graduates. Many openings for professional and specialized personnel such as accountants and auditors, economists, statisticians, and electronic computer personnel also will occur.

Population growth and increased production, sales, and income are expected to produce more financial transactions which banks will handle for individuals, businesses, and governments. Branch banks will continue to grow as banks bring services closer to residents of suburban business centers. More jobs will be created as banks continue to expand their services. These services include the handling of accounts in retail stores; bank charge cards; savings plans for travel and education; estate planning and administration; "on premise" banking facilities where large numbers of people work in one building; and the management of employee pension funds. Approximately 1,500 banks had electronic data processing in 1970 and provided conventional recordkeeping services to other banks and institutions. They also provided services such as account reconciliation and payroll preparation.

The number of additional workers needed to handle the increase in banking activities may be offset somewhat by the continued conversion of many major banking activities to electronic data processing. Even so, employment growth is expected to continue but at a slower pace. Electronic data processing is likely to change bank employment patterns by reducing the number of workers in some occupations while creating other jobs which are new to banks. The effect of these developments will vary from one occupation to another, as indicated in the statements on specific banking occupations which follow.

Bank employees can anticipate steadier employment than workers in many other fields because their employment is less likely to be affected by layoffs during periods when business activity is low. Even when a bank is sold or merged there is little likelihood that workers will lose their jobs. When bank officials find it necessary to curtail employment, they usually do so by not replacing employees who retire or leave their jobs for other reasons.

Earnings and Working Conditions

Earnings of bank clerks, tellers, and officers are discussed in the statements which follow. In addition to their salaries, bank workers receive fringe benefits which are generally somewhat more liberal than those provided by other types of businesses. For example, most banks offer their workers some type of profit sharing or bonus plan; sick leave; 5 to 12 paid holidays a year; and vacations with pay, generally 2 weeks for those who have completed 1 year of service, 3 weeks after 10 to 15 years of service, and 4 weeks after 20 to 25 years of service. In addition, group plans that provide life insurance, hospitalization and surgical benefits, and retirement income are commonplace fringe benefits for many bank employees. Sometimes free or preferred banking services, such as checking accounts or safe deposit boxes, also are provided.

The workweek in banks is generally 40 hours or less; in a few localities, a workweek of 35 hours is common. Tellers and some other types of employees may work at least one evening a week when banks remain open for business. Certain check processors and operators of electronic computing equipment may work on evening shifts.

Generally, bank work is done in modern, clean, well-lighted, and air-conditioned offices.

Sources of Additional Information

Local banks and State bankers' associations can furnish specific information about job opportunities in local banking institutions. General information about banking occupations, training opportunities, and the banking industry itself is available from:

American Bankers Association, Personnel Administration and Management Development Committee, 1120 Connecticut Avenue, NW., Washington, D.C. 20036.

National Association of Bank Women, Inc., National Office, 111 E. Wacker Dr., Chicago, Ill. 60601.

National Bankers Association, 4310 Georgia Ave., NW., Washington, D.C. 20011.

Information on career opportunities in consumer finance can be obtained from:

The National Consumer Finance Association, 1000 16th St., NW., Washington, D.C. 20036.

Information about career opportunities as a bank examiner can be obtained from:

Federal Deposit Insurance Corporation, Director of Personnel, 550 17th St., NW., Washington, D.C. 20429.

BANK CLERKS

Nature of the Work

Bank clerks handle much of the paperwork associated with checking and savings accounts, loans to individuals and business firms, and other bank business. Because of the nature of banking, some of their work differs from the work done by clerks in other kinds of businesses. (Secretaries, office machine operators, receptionists, and other clerical workers whose jobs are much the same in banks as in other businesses are discussed in the chapter on Clerical and Related Occupations.)

The specific duties that must be performed in a particular bank depend on the size of the bank and the nature and scope of the services offered. In a small bank, for example, one clerk may perform a variety of tasks such as sorting checks, totaling debit and credit slips, and preparing monthly statements for mailing to depositors. However, in a large bank, each clerk usually is assigned one kind of work and frequently has a special job title.

Bank clerks known as *sorters* (D.O.T. 219.388) separate bank documents—checks, deposit slips, and other bank items—into different groups and tabulate each "batch" so they may be charged to the proper account; often they use canceling and adding machines in their work. Many banks also employ *proof machine operators* (D.O.T. 217.388) who use equip-

ment that, in one operation, sorts items and adds and records the amount of money involved.

The bookkeeping workers who keep records of depositors' accounts and of bank transactions such as loans to business firms or the purchase and sale of securities are the largest single group of bank clerks. *Bookkeeping machine operators* (D.O.T. 215.388) use either conventional bookkeeping machines or electronic posting machines especially designed for bank work; in most other respects, their work is similar to that of bookkeeping machine operators in other types of establishments. In banks, these workers are sometimes known as *account clerks, posting machine operators, or recording clerks. Bookkeepers* (D.O.T. 210.388) are also employed in banks, usually to keep special types of financial records. The job titles of many bank bookkeepers are related to the kinds of records on which they work—among them, *Christmas club bookkeeper, discount bookkeeper, interest-accrual bookkeeper, trust bookkeeper,* and *commodity loan clerk.* Thousands of *bookkeeping and accounting clerks* (D.O.T. 219.488) are also employed in bookkeeping departments to do routine typing, calculating, and posting related to bank transactions. Included in this group are *reconcilement clerks,* who process statements from other banks to expedite the auditing of accounts; and *trust investment clerks* who post the daily investment transactions of bank customers.

Other clerical employees whose duties and job titles are unique to banking include *country collection clerks* (D.O.T. 219.388) who sort the thousands of pieces of mail which come in daily to a city bank and determine which items must be held at the main office and which should be routed to branch banks or out-of-city banks for collection. Also employed are *transit clerks* (D.O.T. 217.388) who sort bank items such as checks and drafts on other banks, list and total the amounts involved, and prepare the documents so that they can be mailed for collection; *exchange clerks* (D.O.T. 219.388) who service foreign deposit accounts and determine charges for cashing or handling checks drawn against such accounts; *interest clerks* (D.O.T. 219.388) who maintain records relating to interest-bearing items which are due to or from the bank; and *mortgage clerks* (D.O.T. 209.388) who type legal papers affecting title to real estate upon which money has been loaned, and maintain records relating to taxes and insurance on such properties.

New clerical occupations which have been created by electronic data-processing and which are unique to banks, include those of the *electronic reader-sorter operator* who operates electronic check sorting equipment; the *check inscriber or encoder* who operates machines that print information on checks and other documents in magnetic ink to prepare them for machine reading; and the *control clerk* who keeps track of the large volume of documents flowing in and out of the computer division. Other occupations include *card-tape converter operator, coding clerk, console operator, data typist, data converting machine operator, data examination clerk, high speed printer operator, tape librarian, teletype operator,* and *verifier operator*. These workers are employed in an increasing number of banks that use this kind of equipment.

Banks employed more than 500,000 clerical employees of all kinds in 1970; about 9 out of every 10 were women.

Training, Other Qualifications, and Advancement

High school graduation is adequate preparation for most beginning clerical jobs in banks. For the majority of jobs, courses in bookkeeping, typing, business arthmetic, and office machine operation are desirable. Applicants may be given short employment and clerical aptitude tests to determine their ability to work rapidly and accurately, and to communicate effectively with others. Bank clerks work independently and should enjoy attending to details. The nature of the work and the equipment used require bank clerks to follow an established routine.

Beginners may be hired as file clerks, keypunch operators, transit clerks, clerk-typists, or for related work. Some are trained by the bank to operate various office machines. A few start as inside messengers.

A clerk in a routine job may be promoted to a minor supervisory position, to teller or credit analyst, and eventually to senior supervisor. Opportunities for advancement to bank officer positions also exist for outstanding clerks who have had college training or have taken specialized courses in banking.

Additional education obtained while employed—particularly the courses offered by the American Institute of Banking—may be helpful in preparing workers for advancement. (See introduction to this chapter for further information on the Institute's educational program.)

Employment Outlook

Employment of bank clerks is expected to increase slowly through the 1970's. New jobs created by growth, as well as replacements for those who retire, die, or stop working for other reasons, are expected to result in thousands of openings each year. Turnover is high in banks, as in other industries which employ many women in clerical positions. Jobs for clerks will arise as established banks expand their services and new banks are opened. In those banks which install modern electronic equipment, however, fewer opportunities can be expected for check sorters and bookkeeping machine operators. Most employees affected by the changeover will probably be retrained and reassigned, either to new jobs created by the change in equipment and processing methods, or to other duties related to the many new functions and services which banks are introducing. Overall, the growth in the volume of work created by new bank facilities and services is expected to be so great that the total number of clerical workers will continue to rise for some years to come, although much less rapidly than in the recent past. The sharpest increases in employment are expected in occupations related to electronic data processing.

Earnings

According to a Bureau of Labor Statistics survey, clerical workers employed in financial institutions, including banks, usually earned between $70 and $130 a week in 1969. Men's weekly salaries generally ranged between $80 and $130; women earned between $70 and $120 a week.

Among men, Class A accounting clerks and Class A tabulating machine operators—generally experienced employees—received the highest average salaries: $123 and $131, respectively. The highest paid occupation for women was Class A tabulating machine operator, $120.

The lowest average weekly salary among men was earned by office boys, $77. Among women, Class C file clerks—generally beginners—earned the least, $70 a week.

Bank clerks are covered under the Fair Labor Standards Act, a Federal law which provides for a minimum wage. In 1970, the minimum was $1.60 an hour; thus, any clerk who worked a 40-hour week would earn at least $64.

See introductory section of this chapter for information on Places of Employment and Sources of Additional Information; and for additional information on Training, Employment Outlook, and Earnings and Working Conditions.

TELLERS

(D.O.T. 212.368)

Nature of the Work

Every bank, no matter how small, has at least one teller who receives and pays out money and records these transactions. In a very small bank, one teller—often known as an *all-around teller*—may handle transactions of all kinds, but in larger banks different kinds of

transactions usually are assigned to different tellers. A *Christmas Club teller* accepts and records deposits made to Christmas Club savings accounts, for example, and a *note teller* handles certain transactions for clients who have made loans. Other tellers who have special job titles include *commercial* (or *paying* and *receiving*), *savings, foreign exchange, payroll, discount,* and *securities tellers. Commercial* tellers are the most common. They cash customers' checks, and handle deposits and withdrawals from checking and savings accounts. Before cashing a check, the teller must verify the identity of the person to whom payment is made and be certain that the payee's account has sufficient funds to cover the payment. When accepting a deposit, the teller checks the accuracy of the deposit slip and enters the total in a passbook or on a deposit receipt. Tellers may use machines to make change and to total deposits. Tellers handling savings accounts may use a "window" posting machine to print a receipt, record the transaction in the customer's passbook, and simultaneously post the transaction to the bank's ledger.

After banking hours, tellers count cash on hand, list the currency-received tickets on a settlement sheet, and balance the day's accounts. They also do other tasks such as sorting checks and deposit slips. Paying and receiving tellers may supervise one or more clerks.

Approximately 150,000 tellers of all kinds were employed in 1970. A considerable number worked part time; about 9 out of 10 were women.

Training, Other Qualifications, and Advancement

In hiring tellers, banks prefer high school graduates experienced in clerical work. Maturity, neatness, tact, and courtesy are important qualifications because customers deal with tellers far more frequently than with other bank employees. Since tellers handle large sums of money and are bonded, they must meet the standards established by bonding companies.

New tellers usually observe experienced workers for a few days before doing the work themselves under close supervision. Training may last from a few days to 3 weeks or longer. A beginner usually starts as a commercial teller; in large banks which have a separate savings teller's "cage," he may start as a savings teller.

After gaining experience, a competent teller in a large bank may advance to head teller and eventually to bank officer if he has had some college or specialized training offered by the banking industry. (See introduction to this chapter for information about the educational program of the American Institute of Banking.)

Employment Outlook

The number of bank tellers is expected to increase very rapidly through the 1970's, as banks expand their services. An increasing proportion of tellers, however, will work part-time during peak hours to accommodate those customers who transact business during the noon hour and in the evenings. Thousands of openings will occur each year as a result of the increase in employment and the need to replace tellers who retire, die, or stop working for other reasons. Turnover is high among the many thousands of women who work as tellers.

Although increased use of mechanical and electronic equipment may eliminate some routine work and speed other work tellers now perform, total employment is unlikely to be adversely affected.

Earnings

According to a Bureau of Labor Statistics survey, the earnings of nonsupervisory workers, including tellers, averaged about $100 a week in 1970. The range between the lowest and highest salaries depends on factors such as experience, the specific position, and location and size of the bank.

Bank tellers are covered under the Fair Labor Standards Act, a Federal law which provides for minimum wages. In 1970, the minimum was $1.60 an hour; thus, tellers who worked a 40-hour week would earn at least $64.

See Introduction for Places of Employment and Sources of Additional Information, and for general information on banking occupations.

BANK OFFICERS

(D.O.T. 186.118, .138, .168, and .288; 161.118; 189.118 and .168)

Nature of the Work

Practically every bank has a president who directs operations; one or more vice presidents who either act as general managers or have charge of bank departments such as trust, or credit; and a comptroller or cashier who (unlike cashiers in stores and other businesses) is an executive officer generally responsible for all bank property. Large banks also may have treasurers and other senior officers, as well as assistant officers, to supervise the various sections within different departments. Banking institutions employed almost 175,000 officers in 1970; women represented about one-tenth of the total.

A bank officer makes decisions within a framework of policy set by the board of directors and existing laws and regulations. He must have a broad knowledge of business activities, which he can relate to the operations of his particular department. For example, each time a loan officer considers an application, he analyzes the collateral and uses his broad knowledge of business activities. He also evaluates carefully the credit analysis on the individual or business firm applying for a loan. Similarly, the trust officer must understand each account he administers. He must invest wisely to manage trust funds which were established for such purposes as supporting families, sending young people to college, or paying pensions to retired workers. Besides supervising financial services, bank officers advise individuals and businessmen and participate in many different kinds of community projects.

Because of the variety of services offered by banks, a wide choice of officer careers is available for those who wish to specialize in different areas of banking. For example, the *loan officer* must be familiar with economics, production, distribution, merchandising, and commercial law. He also must have the ability to analyze financial statements and know the operations and customs of businesses to which the bank extends credit. Careers in lending include: installment loan officer, commercial loan officer, credit department loan officer, real estate mortgage loan officer, and agricultural loan officer. In trust services, the *trust officer* manages assets belonging to individuals, families, corporations, and institutions. Trust management requires specialization in fields such as financial planning and investment. Specialized careers in trust management include estate administration, trust administration, and investment research. The *operations officer* plans, coordinates, and controls the work flow, updates systems, and strives for bank efficiency. He also trains and supervises a large number of people. Careers in the bank operations area include: Customer services, electronic data processing, and internal services.

Other career specialties include *correspondent bank officer,* who is responsible for relations with other banks; *branch bank manager,* who is responsible for all functions of a branch office; and *international officer,* who is financial advisor to customers in the United States and abroad. A working knowledge of a foreign language and knowledge of a foreign country's geography, politics, history, and economic growth can help those interested in international banking. Other career fields for bank officers are auditing, economics, personnel administration, public relations, and operations research.

Training, Other Qualifications, and Advancement

Bank officer positions may be filled by management trainees or by promoting experienced clerical employees. Outstanding bank clerks may be selected for promotion even though their academic background is limited, but college graduation is the usual requirement for management trainees. A business administration major in finance or a liberal arts curriculum including accounting, economics, commercial law, political science, and statistics serve as excellent preparation for officer trainee positions. Valuable experience may be gained through summer employment programs offered by some banks.

Most large city banks have well-organized officer-training programs usually ranging from 6 months to 1 year. Trainees may start as credit or investment analysts or rotate among bank departments to get the "feel" of banking; bank officers then can better determine the position for which each employee is best suited. Banks too small for formal officer-trainee programs provide other forms of training that enable trainees to understand bank operations.

Advancement to officer positions may come slowly in small banks where the number of these positions is limited. In large banks having special training programs, promotions may come more quickly. For a senior officer position, however, many years of experience are usually necessary before an employee can acquire the necessary knowledge of the bank's operations and customers and of the community.

Although experience, ability, and leadership receive great emphasis when bank employees are considered for promotion to office positions, advancement also may be accelerated by special study. Courses in every phase of banking are offered by the American Institute of Banking, a long-established, industry-sponsored school (See introduction to this chapter for more information on the Institute's program and other training programs sponsored jointly by universities and local bankers' associations.)

Employment Outlook

The number of bank officers is expected to increase rapidly through the 1970's as banking activities expand. Increased use of electronic computers enables banks to analyze and plan banking operations more extensively and to provide new kinds of services. In addition, because bank officers are somewhat older, on the average, than most employee groups, a large number of additional officers will be needed each year to replace those who retire or leave their jobs for other reasons. Several thousand workers will be needed annually because of employment growth and the need to replace bank officers who retire or die. Many other openings will arise as bank officers transfer to other types of employment.

Although college graduates who meet the standards for executive trainees should find good opportunities for entry positions, many officer positions will be filled by promoting people already experienced in banking operations. Competition for these promotions, particularly in large banks, is likely to be keen.

Earnings

According to a private survey conducted in 1969, large banks, insurance companies, and other financial institutions paid salaries ranging from about $580 to $750 a month to new executive trainees who were college graduates.

The salaries of senior bank officers may be several times as great as these starting salaries. For officers, as well as for other bank employees, salaries are likely to be lower in small towns than in big cities.

See Introduction for Places of Employment and Sources of Additional Information, and for general information on banking occupations.

INSURANCE OCCUPATIONS

Insurance is a multibillion dollar business which offers many employment opportunities for young people recently graduated from high school or college and for experienced workers.

There are about 1,800 life insurance companies and more than 3,000 property and liability (sometimes called property and casualty) insurance companies. They conduct their business in main offices, commonly called "home" offices, and in thousands of local sales offices in cities and towns throughout the country. Local offices may be branches operated by an insurance company or they may be operated by independent agents and brokers.

Nature of the Business

Insurance policies are classified into three broad categories: life, health, and property and liability insurance. Some companies sell all lines of insurance; others specialize in one type or more. An increasing number of life insurance companies also sell equities, such as mutual fund shares and variable annuities (contracts yielding periodic payments that fluctuate with the value of securities or other variable factors).

Life insurance companies sell policies which provide not only basic life insurance protection, but also several other kinds of protection. Under some policies, for example, policyholders receive an income when they reach retirement age or if they become disabled and stop working; other life insurance policies may help to pay the costs of educating children when they reach college age, or may give extra financial protection when the children are young. Life insurance is used increasingly to protect business interests and to guarantee employee benefits.

Property and liability insurance provides financial protection against loss or damage to policyholders' property and protects the policyholder when he is responsible for injuries to others or damage to other people's property. This insurance includes protection against hazards such as fire, theft, and windstorm, as well as workmen's compensation and other liability insurance. Both life and property and liability companies may sell accident and health insurance, which assists policyholders in paying medical expenses, and may furnish other benefits for an injury or illness.

An increasing number of insurance policies are written to cover groups—from a few individuals to many thousands. Group policies usually are issued to employers for the benefit of their employees. They most often provide retirement income and life or health insurance, although some furnish automobile or homeowners coverage. In 1968, group life insurance protected about 43 million workers; the number of policies in force was double the number 10 years earlier.

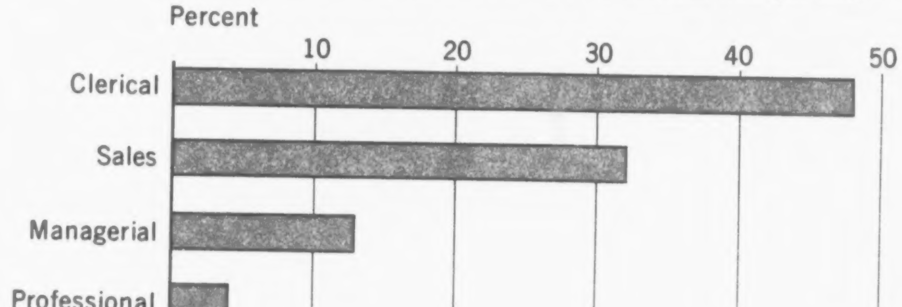
Insurance Workers

The insurance business provided jobs for about 1.4 million people in 1970. The great majority were clerical and sales workers. (See chart 35.)

Almost half of all insurance company employees are in clerical and related jobs—a much larger proportion than in most other industries. These workers keep records of premium payments, services, and benefits rendered to policyholders. The majority are secretaries, stenographers, and typists; operators of bookkeeping and other kinds of office machines; or general office clerks. They do much the same kind of work in insurance companies as in other types of business enterprises.

Other clerical workers occupy

㉟ **Among the approximately 1.4 million[1] workers employed in the insurance business almost one-half are in clerical occupations**



[1] ESTIMATED, 1970

SOURCE: BUREAU OF LABOR STATISTICS

positions of responsibility which require extensive knowledge of one phase of insurance or more. This group includes *claim adjusters* (D.O.T. 241.168) and *claim examiners* (D.O.T. 249.268) who decide whether claims are covered by the policy, see that payment is received on each claim, and when necessary, investigate the circumstances which initiated the claim. (See the statements on Claim Adjusters and Claim Examiners later in this chapter.)

Salesmen are a key group of workers in insurance companies. About one-third of all insurance workers are sales persons—chiefly agents, brokers, and others who sell policies directly to individuals and business firms. Agents and brokers usually are responsible for finding their own customers or "prospects," and for seeing that each policy they sell provides the special kind of protection required by the policyholder. (A statement on Insurance Agents and Brokers is included in the chapter on Sales Occupations.)

About 1 out of 8 insurance workers is in a managerial position. Managers in charge of local offices, through which most insurance policies are sold, often spend part of their time in sales work. Others, who work in home offices, are company officials or administrators in charge of actuarial calculations, policy issuance, accounting, investments, loans, and additional office work. The large-scale investment activities of many insurance companies make financial administration a particularly important area of employment.

Professionals, employed mainly at home offices, represent about 1 out of 25 insurance workers. These specialists, working closely with the managerial personnel in insurance companies, study insurance risks and coverage problems, analyze investment possibilities, prepare financial reports, and do other professional work. Included among them is the *actuary* (D.O.T. 020.188), whose job is unique to the insurance field. Actuaries make statistical studies relating to various kinds of risks and, on the basis of these studies, determine how large the premium rate on each type of policy should be. (See statement on Actuaries.) Another specialist is the *underwriter* (D.O.T. 169.188), who reviews insurance applications to evaluate the degree of risk involved. Underwriters decide whether to accept or reject an application for insurance; they also determine which premium rate should apply for each policy issued. (A statement on underwriters is included in this chapter.)

The work of most other professional employees in insurance companies is fundamentally the same as in other industries. Accountants, for example, analyze insurance company records and financial problems relating to premiums, investments, payments to policyholders, and other aspects of the business. Engineers work on problems connected with policies covering industrial work accidents, damage to industrial plants and machinery, and other technical matters. Lawyers interpret the regulations which apply to insurance company operations, handle the settlement of some kinds of insurance claims, and do other legal work. Investment analysts evaluate real estate mortgages and new issues of bonds and other securities, analyze current investments held by their companies, and make recommendations on when to hold, buy, or sell. As more electronic computers are installed to handle office records, an increasing number of data processing specialists, including programers and systems analysts, are being employed. Many companies also employ editorial, public relations, sales promotion, and advertising specialists.

About 1 out of 50 workers in the insurance business performs maintenance or custodial work similar to that required by other large business organizations.

Additional information about many of these professional, clerical, and maintenance occupations is contained elsewhere in this *Handbook.*

Places of Employment

Large numbers of insurance workers are employed in California, Connecticut, Illinois, Massachusetts, New Jersey, New York, and Texas, where the home offices of some of the largest insurance companies are located. Many insurance workers also are employed in agencies, brokerage firms, and other sales offices in cities and towns throughout the country. Almost all sales personnel work out of local offices, whereas the majority of professional and clerical workers are employed in company home offices.

More than half of all insurance workers are employed by life insurance companies and agencies; included in this group are some large companies with thousands of employees. Companies which deal mainly in property and liability insurance, although more numerous than the life insurance companies, generally have fewer employees. Many local agencies and sales offices are also small, regardless of the type of insurance they handle.

Training, Other Qualifications, and Advancement

Insurance offers job opportunities for people having very different educational backgrounds and talents. Some positions require much managerial and administrative experience and ability; others require college training in mathematics, accounting, and engineering; but still others involve only routine duties which can be learned on the job.

Graduation from high school or business school is regarded as adequate preparation for most beginning clerical positions. Courses in typing, business arithmetic, and the operation of office machines may be valuable. These special skills often are required for jobs in insurance company offices, and this kind of training provides a background of information which helps employees advance to more responsible positions.

Engineering, accounting, and other professional positions in insurance companies usually require the same kinds of college training as they do in other business firms. College-trained people also are preferred for managerial positions, many of which are filled by promotion from within. In professional and managerial work requiring contact with the public, as well as in sales work and claim adjusting, the employee should have a pleasant disposition and an outgoing personality. Since insurance companies often encourage participation in community organizations, he should enjoy working with others in a social situation. An employee whose work requires frequent contact with policyholders should inspire confidence in his ability to protect the customer's interests.

Insurance companies and associations of companies and agents offer several kinds of training programs to help employees prepare for better jobs. The Insurance Institute of America, for example, has home study courses for property and liability insurance adjusters, claim examiners, underwriters, loss prevention specialists, managerial personnel, and salesmen. The Institute awards certificates to those who pass their examinations. The American College of Life Underwriters, the National Association of Life Underwriters, and the Life Underwriter Training Council offer life insurance courses that stress the services agents may provide to policyholders. Other courses, especially designed to help clerical employees gain a better understanding of life insurance and life insurance company operations, relate to the organization and operation of both home and field offices. They are given under the auspices of the Life Office Management Association which also provides programs for the development of supervisory and managerial personnel.

Employment Outlook

Employment in the insurance industry is expected to rise moderately through the 1970's. New jobs to be filled, plus openings that occur as employees retire or stop working for other reasons, are expected to total many thousands each year. Turnover is particularly high in this industry because of the many young women in clerical jobs who work only for a few years and then leave to care for their families. Still other openings will occur as insurance workers leave their jobs for employment in other industries.

The expected increase in employment will result mainly from a rapidly increasing volume of insurance business. A growing population will purchase more life insurance, as well as more insurance which provides retirement income and funds for their children's education. Others who do not presently have insurance may become policyholders; for example, advances in medical science are making life insurance available to persons who were formerly rejected as poor insurance risks. The need for property and liability insurance also will increase as a rising standard of living enables more individuals and families to own one automobile or more, buy homes, and make other major purchases which are usually insured. In the business world more insurance of this kind also will be required as new plants are built, new equipment is installed, and more goods are shipped throughout the country and the world. Furthermore, as the coverage of State workmen's compensation laws is broadened, more employers may need workmen's compensation insurance.

Insurance employment probably will rise at a somewhat slower rate than the volume of business handled by insurance companies. As additional types of coverage become available through group contracts and more multiple-line policies are issued (those which cover a variety of insurance risks formerly covered in separate policies), the workload of sales personnel in local offices will be reduced. As more companies install electronic computers and other equipment to process some of the routine paperwork now done by clerks, changes in insurance company employment will occur. The total number of insurance company clerical jobs probably will continue to rise, especially those jobs that require special training, but the proportion of routine jobs is likely to decline.

Insurance workers have better prospects of regular employment than workers in many other industries. Most businessmen regard property and liability insurance as a necessity, both during economic recession and in boom periods, and private individuals also attempt to retain as much basic financial protection as possible, even when their incomes decline.

Earnings and Working Conditions

A 1968–69 survey of nonsupervisory employees in insurance companies, banks, and related businesses showed a wide range of salaries among the individuals in the companies surveyed. Some clerical workers in beginning, routine jobs earned less than $70.00 a week; some experienced employees in more responsible positions earned up to twice that amount. Employees in beginning jobs as junior file clerks averaged $71.50 a week and office girls, $73.00. Switchboard operators averaged between $87.50 and $99.00, depending upon skill and experience. General stenographers averaged $88.00 a week and senior stenographers averaged $100.50. Typists, one of the largest groups covered in the survey, averaged $79.00 for beginning jobs and $90.50 for experienced workers. The average for accounting clerks ranged from $84.50 to $123.50, depending on experience and skill.

To some extent, these differences in salary levels may be due to differences in the specific job duties of the employees involved, and in the firms for which they worked. Salary levels in different parts of the country also vary; earnings are generally lowest in southern cities and highest in northeastern and western metropolitan areas. (See chapter on Clerical and Related Occupations for additional information about the earnings of workers in other office occupations found in insurance companies.)

Starting salaries for professional workers are generally comparable with those for similar positions in other industries and businesses. According to limited information available from a private survey of life insurance companies, 1970 college graduates were paid starting salaries ranging between $7,475 and $8,590 a year. Specialists having several years' experience in insurance may receive annual salaries of $10,000 to $15,000; many earn $25,000 a year or more. Unlike salaried professional workers, agents and brokers earn commissions on the policies they sell. (See the statement on Insurance Agents and Brokers.)

Based on limited data, annual salaries for supervisors in life insurance companies ranged from $8,900 to $18,870, depending upon the type of company operation. Salaries for supervisors in property and liability companies ranged from $9,200 to $19,050 a year.

Except for agents and brokers, who must sometimes extend their working hours to meet with prospective clients, insurance company employees usually work between 35 and 40 hours a week. The number of paid holidays is somewhat greater than in many other industries. Two-week paid vacations generally are granted employees after 1 year of service; in most companies, vacations are extended to 3 weeks after 10 years and, in some, to 4 weeks after 20 years. Practically all insurance company workers share in group plans providing life and health insurance, as well as retirement pensions.

Sources of Additional Information

General information on employment opportunities in the insurance business may be obtained from the personnel departments of major insurance companies or from insurance agencies in local communities.

Other information on careers in the insurance field is available from:

Institute of Life Insurance, 277 Park Ave., New York, N.Y. 10017.

Insurance Information Institute, 110 William St., New York, N.Y. 10038.

National Association of Insurance Agents, 96 Fulton St., New York, N.Y. 10038.

American Mutual Insurance Alliance, 20 North Wacker Dr., Chicago, Ill. 60606.

For additional information on the salaries of clerical workers in finance industries, including insurance, see:

Area Wage Surveys, Metropolitan Areas, United States and Regional Summaries, 1968–69 (BLS Bulletin 1625–91, 1970). Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

CLAIM ADJUSTERS

(D.O.T. 241.168, 191.268)

Nature of the Work

Claim adjusters investigate, negotiate, and settle claims regarding a policy made by those who have suffered a loss. Most adjusters work for companies that sell property and liability insurance, although some are assigned claims arising under accident or health insurance policies. (See the statement on Claim Examiners for a discussion of claim settlement in life insurance.)

Upon receipt of an insurance claim, the adjuster must determine if the loss is in fact covered by the policy; if so, it is his job to decide the amount of the loss. The adjuster investigates all circumstances relating to the claim, using a variety of sources such as records, reports, physical data, and witnesses. From an analysis of the facts he draws a conclusion about the extent, if any, of the insurance company's obligation. Sometimes his investigative work may be aimed at determining the extent of a third party's liability. In the event that a third party bears some responsibility in a loss, the adjuster's company may collect a portion of the payment made to the policyholder from this third party or his insurance company.

When the adjuster determines that his company is liable, his job is to negotiate with the claimant and settle the case. A claims man must avoid making settlements unduly large in relation to the real value of a loss; at the same time, he must see that valid claims are paid promptly. Some adjusters have the authority to issue a draft on company funds. Others submit a report of their findings to the insurance company which then pays the claim.

Some adjusters work with all lines of insurance. Others specialize in handling claims such as those arising from damage to property by fire; ocean marine losses; automobile damage; workmen's compensation losses; or bodily injury.

There are two major areas of specialization in claim adjusting: Property claims that result from loss or damage; and claims resulting from bodily injury. Bodily injury negotiations involve specialized knowledge of law and medicine. A claims man frequently advances to this type of adjusting after several years' work in another adjusting line or as an all-lines adjuster.

Most of an adjuster's job is carried on outside his office. He may have to work at a construction site where an accident has occurred, or at the location of a fire or burglary. While the adjuster may spend the greater portion of a working day driving from place to place investigating claims, this travel usually is within a single city or regional area.

Adjuster discusses loss with claimant.

An adjuster is responsible for planning his own schedule of activities necessary to the proper disposal of a claim. He also must keep a careful record of his expenses so that his employer can reimburse him.

Adjusters increasingly use portable tape recorders in their work. These have the advantage of shortening the amount of time an adjuster must spend in personally interviewing a witness or claimant.

Places of Employment

An estimated 114,000 claim adjusters were employed in 1970; most were men. Adjusters are employed by adjustment bureaus (organizations formed by several insurance companies to settle claims), by insurance companies, and by independent adjusting firms. Some are self-employed. "Staff" adjusters are on the payrolls of insurance companies; independent adjusters may be hired by independent adjusting firms or may contract their services privately for a fee.

A small number of public adjusters represent the insured rather than the insurance company. These adjusters usually are retained by banks, financial organizations, and other business firms to handle fire and allied losses to property. They negotiate claims against insurance companies and deal with the adjusters for such companies.

The beginning adjuster can look forward to working in almost any area of the United States, since claims must be settled locally in all parts of the country. Occasionally, the adjuster may be required to travel to the scene of a disaster, such as a hurricane or a riot, to work with local adjusting personnel. Some cases result in travel outside the United States.

Training, Other Qualifications, and Advancement

A variety of educational backgrounds are adaptable to success in claim adjusting. Although the trend is toward the employment of college graduates and some companies require a degree, men without college training are accepted by many firms. Specialized job experience might qualify an individual for employment as an adjuster. For example, a person experienced in automobile repair work may qualify as an auto adjuster. It is likely, however, that an adjuster who lacks college training will be slower in advancing to senior or supervisory positions.

No specific field of college study is recommended; many successful adjusters have general liberal arts backgrounds. An adjuster whose background is in business subjects or accounting might choose to specialize in loss from business interruption or damage to stocks of merchandise. A man with college training in engineering or law will find his education helpful in adjusting casualty claims. Legal training is desirable, although few employers demand that beginning adjusters have a law degree.

Although insurance company adjusters frequently are exempt from State licensing provisions, nearly three-fourths of the States and Puerto Rico require adjusters to be licensed or to pay occupational fees. State licensing regulations vary widely. However, applicants usually must comply with one or more of the following requirements: Pass a written examination covering the fundamentals of adjusting; furnish character affidavits; be 20 or 21 years of age and fulfill certain State residency qualifications; offer proof that they have completed an approved course in insurance or loss adjusting; and file a surety bond.

Many insurance companies and adjustment firms offer programs for beginning adjusters that combine on-the-job training with home study courses. The Insurance Institute of America also offers an educational program for adjusters leading to the Institute's Diploma in Insurance Loss and Claim Adjusting. This six-semester study program is open to all adjusters, and the Institute's diploma is awarded upon successful completion of six national examinations. Adjusters can prepare to take these examinations by independent home study, through company or public classes, or by formal college courses in insurance. A professional Certificate in Insurance Adjusting also is available from the College of Insurance in New York City.

Regardless of place of employment, most adjusters begin their training with an orientation course in general insurance principles. A beginning adjuster is assigned to work on small claims under supervision of an experienced adjuster. This training may be given at one of the metropolitan training centers maintained by some large insurance companies or by assignment to a field office. As the trainee adjuster learns more about claim investigation and settlement, both through home study and supervised experience, he gradually assumes responsibility over claims that are more difficult to settle or higher in loss value.

Because an adjuster's work brings him into contact with claimants, witnesses, and policyholders, he must be skillful in adapting to a variety of persons and situations. He should enjoy working with people from different backgrounds and be able to gain their respect and cooperation. When an adjuster's evaluation of a claim differs from that of the person who has suffered the loss, he must exercise considerable tact and diplomacy in explaining the reasons for his conclusions. An adjuster should be able to converse easily with the persons from whom he seeks information in settling a claim; he must "speak the language" of the police detective, the auto damage appraiser, and the medical specialist, to name a few. Habits of keen observation and careful attention to details are valuable to an adjuster in his work, which demands that he gather all facts pertinent to a claim and weigh them together in making a decision.

Promotions to senior or chief adjuster depend upon an individual's demonstrated performance in handling his claim assignments, the evaluations of his supervisors, and his progress in any of the study courses available through his company, insurance associations or local educational institutions. The adjuster who demonstrates administrative skills may be promoted to supervisory responsibilities in the claims department of a field office. With continued evidence of his ability to organize work flow and make decisions, he may advance to a managerial position in a branch office or in the home office organization. An adjuster who boasts a background in law might be promoted to trial attorney or legal manager in his firm's home office.

Employment Outlook

Employment of claim adjusters is expected to increase at a rapid rate through the 1970's. In addition to openings as a result of growth in the occupation, many jobs will become available each year from the need to replace experienced claim adjusters who die, retire, or transfer to other fields.

The expected rapid growth in employment opportunities for adjusters reflects anticipated expansion in total volume of insurance sales and resulting claims, especially by property and liability insurance companies which employ most adjusters. Various factors expected to contribute to an expanded volume of insurance sales include continued population growth, rising personal incomes, and changing patterns of consumer demand for goods and services. A rapid rate of new family formation should result in increased purchases of consumer durables, such as household furnishings and appliances, that require insurance protection. Automobile insurance, accounting for nearly half the total volume of property and liability sales in recent years, should grow rapidly as more families purchase second and third vehicles. In addition, greater population density will increase the risk of accidents, fires, and thefts, with the effect of stimulating demand for these types of insurance coverage.

Since much of an adjuster's time is spent in personal contact with claimants and others who must be interviewed regarding a loss, the greater volume of claims should result in a substantial increase in employment requirements for claim adjusters. Because the nature of an adjuster's work usually demands on-the-scene investigation of facts and events, it is unlikely that consolidation of field operations will significantly reduce the number of claim adjusters assigned locally.

Earnings and Working Conditions

According to an American Insurance Association/American Mutual Insurance Alliance survey of companies selling property and liability insurance, the average annual salary of an all-lines adjuster was $9,100 in 1970; salaries generally ranged from $7,300 to $11,800 a year. Adjusters who specialized in ocean marine and cargo claims averaged $10,200 a year, and their salaries ranged from $8,300 to $12,600 annually.

Adjusters having supervisory responsibilities earned average annual salaries of $11,400; their earnings ranged from $9,200 to $14,600. Some supervisory adjusters earned as much as $18,000 annually. Most public adjusters are paid a percentage of the amount of the loss adjustment—generally 10 percent. An adjuster also may be furnished a company car or reimbursed for use of his own vehicle during business hours.

Claim adjusting is not a desk job. It requires that a person be physically fit since a substantial portion of his day may be spent in driving from one place to another, walking about out of doors, and climbing stairs. An adjuster may be required to work evenings or weekends in order to interview witnesses and claimants when they are available. Since most companies provide both immediate and 24-hour claim service to their policyholders, some adjusters always must be on call. A complicated claim can result in an adjuster's working long and unusual hours.

Claim adjusting is a demanding job and at the same time a challenging one that requires imagination and the ability to weigh a group of facts to reach a conclusion. No claim is precisely like any other, so an adjuster's work offers the stimulus of continual variety as well as the satisfaction of helping someone who has suffered a loss.

Sources of Additional Information

Information about licensing requirements for claim adjusters may be obtained from the department of insurance in each State. General information about a career as a claim adjuster is available from the home office of many property and liability insurance companies. Information regarding claim adjusters also may be obtained from:

Insurance Information Institute, 110 William Street, New York, N.Y. 10038

Information about a career as a public insurance adjuster is available from:

National Association of Public Insurance Adjusters, 1613 Munsey Building, Baltimore, Md. 21202

CLAIM EXAMINERS

(D.O.T. 168.288 and 249.268)

Nature of the Work

Although policyholders expect their insurance claims to be honored promptly, a number of important questions must be answered first. A claim examiner, who also may be known as a claim representative or claim reviewer, investigates details of an insurance loss to provide these answers. His investigation may include reviewing claim applications to check completeness and accuracy; interviewing policyholders or medical specialists; consulting policy files to verify information on a claim; and calculating benefit payments.

The claim examiner's duties vary, depending on the type of insurance sold by his employer. When this is life, accident, and disability insurance, claim examiners usually are assigned to particular types of claims, such as group or health and disability. These examiners investigate and approve payment on all claims up to a certain dollar amount. Claims beyond this amount are referred to a senior examiner who has a higher approval limit.

In property and liability insurance companies most of the investigating is done by *claim adjusters*. (See the statement on Claim Adjusters for a discussion of claim settlement in property and liability insurance.) In these companies the claim examiner usually is a home office employee who reviews insurance claims to determine whether adjusters are following proper procedures in claim handling. Some property and liability firms employ claim workers to handle small claims, such as those arising over minor property damage to an automobile. These workers are called "inside adjusters" or "desk adjusters."

In both life insurance and property and liability insurance companies, some claim examiners process only unusual or questionable claims, referred from field or regional offices to the home office. These examiners may be responsible also for reviewing routine claims settled by the regional office staffs. This review involves determining validity of the claim and correctness of the decision already made by the branch office that handled it. The examiner makes this determination by comparing data on the processed claim application, death certificate, or physician's statement with the policy file.

Regardless of the type of insurance sold, all claim examiners must develop a thorough knowledge of their company's settlement procedures and basic policy provisions. They can refer to company claim manuals describing this information in detail, but efficient handling of several claims a day demands that an examiner be familiar enough with the manuals to make constant referral unnecessary. A claim examiner must be well acquainted also with company records and forms since he frequently works with data furnished by other company divisions. Besides verifying a claim and approving its payment, a claim examiner also maintains claim records and prepares claim reports. As a result, a portion of his time may be spent in the preparation and submission of data to his company's data processing section.

To correct errors or omissions on a claim form or to verify questionable facts, a claim examiner may need to correspond with investigating companies, field managers, agents, and policyholders. Occasionally, he travels to a field location where he obtains this information by personal interview. The examiner who has advanced to this level of responsibility may be asked also to serve on committees, conduct surveys of claim practices within his company, and help to devise more efficient systems for processing claims. He may have contact with State insurance departments and other companies regarding claim policies and practices in his firm. At this level, the claim examiner's job demands some knowledge of Federal and State insurance laws and regulations, and he also may appear in court to furnish testimony on contested claims.

Places of Employment

An estimated 29,000 claim examiners were employed in the insurance industry in 1970; about half were women. Claim examiners are employed by all types of insurance companies, life as well as property and liability.

Claim examiners work in insurance company home offices, in regional offices, and in field offices. The latter frequently are located in small towns and cities where the companies sell and service their insurance products. Large regional offices and home offices are organized along similar lines; they have separate departments for underwriting, claims, and other major functions. Although jobs as claim examiners are available in most areas of the United States, higher level jobs generally are found in regional or home offices.

Training, Other Qualifications, and Advancement

Although many employers prefer to hire college graduates for claim examiner positions, applicants having good high school records are accepted by many firms if they have additional experience in clerical work or some college training. However, the type of work performed in entry level positions differs. The employee who has a high school education begins in a clerical job, perhaps as a claim processor in a group life or health department. College graduates, or those having 2 years or more of college training, may begin work as junior claim examiners. Although courses in insurance, economics, or other business subjects are helpful, a major in almost any college field is adequate preparation. College-trained employees can anticipate promotion to senior claim representative or claim examiner positions after a year or more; high school graduates usually need several years' experience before advancing to one of these positions. Advancement to most supervisory claim examiner jobs demands a college education. Although experience can sometimes be substituted for a part of the work leading to a college degree, the employee who lacks formal college training generally advances at a slower rate.

The beginning claim examiner is given on-the-job training under the direction of an experienced claim manager. If the trainee is a college graduate, his on-the-job training may be combined with courses in insurance fundamentals or personnel management designed to prepare him for supervisory claim work. Many property and liability insurance companies follow a promotion-from-within policy in selecting claim examiners from the ranks of former claim adjusters. The latter have received much of their training for examiner positions through on-the-job experience in adjusting claims.

The Life Office Management Association (LOMA) cooperates with the International Claim Association in offering a Claims Education Program for life and health insurance claim examiners. The program is part of the LOMA Institute Insurance Education Program leading to the professional designation of FLMI (Fellow, Life Management Institute) upon successful completion of eight written examinations. Most insurance companies encourage study by making educational materials available to employees enrolled in the LOMA Institute Program. Many firms offer classroom instruction in preparation for the annual examinations.

Certain aptitudes and skills are helpful to the examiner. Since he must communicate, by letter and telephone, with his company's sales force, field managers, and policyholders, a claim examiner should be able to express himself clearly. Because he has written and spoken communication with persons of different educational backgrounds, he must be flexible in adapting his manner of writing or speaking to the circumstances. In addition, since he has frequent contact with the company's medical and legal departments, he needs a knowledge of medical and legal terms and practices. Because the claim examiner may need to check premium payments, policy values, and other numerical items in processing a claim, some skill in performing mathematical calculations is an asset. This is not a good job choice for a person who overlooks details or one who has a poor memory for facts.

Advancement may come by different routes. The individual who shows unusual competence in claim work sometimes can advance within the claim department—either to the position of claim approver or to another supervisory claim job. A claim supervisor may have as many as 50 to 60 employees under his direction, and devotes much of his time to administrative duties and to final approval of unusual claims. Though supervisory claim positions are available in field as well as regional and home offices, many examiners find promotion to a supervisory job requires transfer either to a larger branch office or to the company home office. A claim examiner with a college education should find opportunity for advancement. It may exist either within the claim department or in a related area of company operations, such as underwriting, data processing, or administration.

Employment Outlook

Employment requirements for examiners are not expected to increase over the 1970–80 period. Although rapid population growth, new family formations, and rising personal income should stimulate growth in insurance sales, the increased volume of claims is not likely to involve comparable increases in examiner manpower. Electronic data processing methods and equipment will enable proportionately fewer claim examiners to process an increased volume of claims, especially those of a routine nature and many that arise under group life and health insurance coverage. Besides, as smaller banch office operations continue to be consolidated, economies of scale will enable insurance companies to process a rapidly expanding volume of claims with a relatively stable work force.

Although openings resulting from employment growth are expected to be limited, some positions will become available each year of the next decade as claim examiners die, retire, or transfer to other fields. These will be found in metropolitan centers where insurance employment is concentrated. Competition for the relatively few supervisory claim openings is expected to be keen.

Earnings and Working Conditions

Earnings vary by type of company and location. According to limited information available, annual salaries for claim examiners employed by life insurance companies ranged between $7,700 and $13,050 in 1970. Salaries in the Western United States and in smaller companies were among the lowest. Most claim examiners hired as trainees by life companies earned $6,400 a year or more; claim supervisors for these companies had minimum annual salaries of about $10,300. Some supervisors earned $16,000 a year or more.

An American Insurance Association/American Mutual Insurance Alliance survey of property and liability companies provided earnings data for their claim examiners. In 1970, property and liability claim examiners had average annual earnings of $7,700, and many earned more than $9,800 a year. Claim supervisors employed by these companies had annual earnings which ranged from $9,200 to $14,600.

Claim examiners usually perform their duties in the pleasant work surroundings of large, well-ventilated office buildings. Most claim examiners work 35 to 40 hours a week, although an examiner may work longer hours at times of peak claim load or when quarterly and annual statements are being prepared. (See the statement on Insurance Occupations for additional information on working conditions and employee benefits.)

Sources of Additional Information

General information about a career as a claim examiner is available from the home office of many life insurance and property and liability insurance companies and also from:

Institute of Life Insurance, 277 Park Avenue, New York, N.Y. 10017

Insurance Information Institute, 110 William Street, New York, N.Y. 10038

UNDERWRITERS

(D.O.T. 169.188)

Nature of the Work

Insurance companies assume millions of dollars in risks each year, by transferring chance of loss from their policyholders to themselves. The policyholder pays for this service through regular premiums. An underwriter's primary function is to select the risks his company will insure. (The term underwriter sometimes is used in referring to an insurance salesman; see the statement on Agents and Brokers elsewhere in the *Handbook* for a discussion of that occupation.)

An underwriter decides the acceptability of various types of risks by analyzing information contained in insurance applications, reports of safety engineers, and actuarial studies (reports describing the probability of insured loss). In making a decision, the underwriter also checks his company's established practice. When working in an area not covered by rule or precedent, however, he must exercise considerable personal judgment. If an underwriter is too conservative in appraising risks, his company may lose business to a competitor. On the other hand, if his underwriting actions are too liberal, his firm may have to pay too many claims in the future.

When deciding that a policy is an acceptable risk, an underwriter may outline the terms of the contract, including the amount of premium. Certain underwriters may perform other duties as well. In a small company, for example, they may have duties such as policy issuance or sales management. Underwriters frequently correspond with policyholders, agents, and management

Underwriter discusses information on a customer's insurance application.

personnel about policy cancellation or requests for information. In addition, they sometimes accompany salesmen on appointments with prospective customers.

Another of the underwriter's tasks is to judge the need for issuing a policy at a higher than standard premium because extra risk is involved. In general, the premium rate is figured for an average risk. On a life insurance policy, for example, the rate is based on persons in good health who work in occupations where there are no substantial hazards. A policy can be issued to those whose health is below normal or whose occupation involves some risk if the underwriter charges a higher premium as compensation.

As underwriters gain experience, they are given more difficult cases to evaluate and policies bearing larger face value. In addition, they assume the difficult task of reviewing applications to renew policies on which losses already have occurred. More experienced underwriters also help conduct formal or informal training sessions for junior underwriters and may supervise clerical staff members who deal with salesmen and policyholders.

Most underwriters specialize in one of the three major categories of insurance: life, property and liability, or health. In turn, life underwriters may specialize in one variation or more of life insurance, such as group or individual life policies. These underwriters must thoroughly evaluate medical statistical studies and the applicants' credit reports in reaching their decisions.

The property and liability underwriter's specialty is differentiated by "line" of risk insured, such as fire, automobile, marine, and workmen's compensation. Fire underwriting demands extensive contact with rating bureaus (organizations supported by insurance companies to develop premium rates). An automobile underwriter, on the other hand, devotes a significant share of his time to analyzing past experience as revealed by company statistics. Some underwriters handle "multi-peril" business insurance exclusively. These specialists, who are called commercial account underwriters, must evaluate a firm's entire operation in appraising the degree of risk involved in approving an insurance application.

A group insurance policy insures all persons in a specified group through a single contract. One duty of the group underwriter is to analyze the overall composition of the group insured to be certain that total risk involved is not excessive. Some group underwriters perform other functions similar to those of an insurance salesman (such as meeting with union or employer representatives to discuss the types of policies available to their group).

Places of Employment

An estimated 55,000 underwriters were employed in the insurance industry in 1970. About three-fourths were property and liability underwriters, who worked in field or home offices of insurance companies.

In contrast to the property and liability part of the business, most life insurance underwriting is performed by home office employees. Some life insurance underwriters work in large regional offices organized along much the same lines as the company home office, that have separate departments for group, individual life, and health insurance. Most underwriters are men.

Training, Other Qualifications, and Advancement

College graduates are sought increasingly for entry-level positions in underwriting. Employers usually look for candidates who have degrees in liberal arts or business administration, although a major in almost any college field provides a good general background. Although high school graduates are not barred, their opportunities for advancement are limited. They generally begin in clerical positions, perhaps as underwriting clerks. High school graduates who perform satisfactorily in such jobs, and demonstrate an aptitude for underwriting tasks, then may be trained on the job as underwriters.

The entry-level job for a college graduate is generally that of underwriting trainee or junior underwriter. A beginning underwriter usually goes through a training period when he participates in a program of study at the office, and carries out assignments under the direction of an experienced risk appraiser. During this training period, the beginner may learn from claim files the factors associated with certain types of losses and from renewal underwriting decisions the experience of the risks his company has insured in the past.

Many underwriters supplement their on-the-job training by home study courses and instruction at home office schools or at local colleges and universities. Although most companies do not require it, this supplemental training helps in gaining advancement. Underwriters have a choice of several independent study programs available through insurance associations such as the American Institute for Property and Liability Underwriters; the American College for Life Underwriters; the Home Office Life Underwriters Association and the Institute of Home Office Underwriters; and the Life Office Management Association. Many firms pay tuition and the cost of books for those employees who satisfactorily complete courses in underwriting. Some companies also offer salary increases as an incentive.

Underwriting can be a satisfying career for a young man or woman who is patient with details and who enjoys relating and evaluating facts. The young person who dislikes being tied to a desk and prefers working with people rather than evaluating facts should consider other career fields. In addition to powers of analysis and good judgment, an underwriter must be imaginative and aggressive, especially when need arises to obtain additional information from outside sources.

As an underwriter's skills develop, he may be promoted to senior underwriter or supervisory underwriter approving policies with substantial face values and performing certain training and administrative functions. An underwriter who demonstrates competence and who completes available study courses may advance further to a position as chief underwriter or underwriting manager of a department. An underwriting manager may move on to a senior managerial appointment after several years.

Employment Outlook

Employment opportunities for underwriters are expected to grow moderately during the 1970's. Many will arise in metropolitan centers where insurance workers now are concentrated; others will result from a demand for underwriters to work in field offices, especially in property and liability insurance. In addition to positions created by employment growth, many job openings will result from the need to replace workers who die, retire, or transfer to other fields.

Several factors point to an expanding market for insurance sales through the 1970's and a resulting need for underwriters. Continued population growth and higher personal incomes should stimulate purchases of life insurance. Property and liability insurance sales should expand with increased purchases of automobiles and other consumer durables. Both spending for new home construction and the American public's growing security consciousness should contribute to demand for more extensive insurance protection. Heightened competition among insurance companies and changes in regulations affecting investment profits also are expected to increase the industry's need for competent men and women to work in underwriting.

Although mechanized handling of routine policy applications may reduce employment opportunities for underwriting clerks, the effect on total employment of underwriters should be negligible.

Earnings and Working Conditions

Salaries of life insurance underwriters ranged from $7,360 to $12,500 a year in 1970, according to a Life Office Management Association survey of 79 U.S. companies. Earnings differed substantially by area; employees in the South and West averaged lower salaries than those in the Eastern and Central States. Experienced life insurance underwriters employed by companies located in metropolitan New York earned annual salaries between $10,600 and $15,620; supervisors of underwriting in life companies earned $11,620 to $21,140 a year. For all levels of life insurance underwriter, salaries were highest in large companies.

An American Insurance Association/American Mutual Insurance Alliance survey of companies engaged in selling property and liability insurance revealed that underwriters' annual earnings ranged from $8,560 to $10,300 in 1970. Earnings varied by line of underwriting specialty; ocean marine underwriters earned the highest annual salaries. Underwriting supervisors in property and liability insurance companies averaged $11,730 annually; some earned nearly $15,000 a year.

Most underwriters have desk jobs that require no unusual physical activity. Underwriting is performed in pleasant, quiet surroundings; in general, insurance company offices are spacious and air conditioned during the summer months. Some underwriters may work irregular hours when traveling to advise field personnel or attending underwriting seminars, or at times of peak load in policy applications. The average work week for an underwriter is 35 to 40 hours, and most insurance companies have liberal paid vacation policies and offer other employee benefits. Since relatively few underwriting decisions are reviewed at a higher level, the underwriter holds a job of considerable responsibility.

Sources of Additional Information

General information about a career as an insurance underwriter is available from the home office of many life insurance and property and liability insurance companies. Information about career opportunities as an underwriter also may be obtained from:

Institute of Life Insurance, 277 Park Avenue, New York, N.Y. 10017

Insurance Information Institute, 110 William Street, New York, N.Y. 10038

American Mutual Insurance Alliance, 20 North Wacker Drive, Chicago, Ill. 60606

SERVICE AND MISCELLANEOUS

The long-term growth in the American economy has created a growing demand for services of all kinds. A growing share of our national wealth and manpower is being devoted to services as a result of greater emphasis on medical care, education, personal services, and recreation. In many ways, this rapid growth reflects the country's aspirations for a better and fuller life for all of its citizens.

In today's job market, the service industries represent an important source of employment to new as well as experienced workers, and offer job opportunities to persons having various levels of skills, training, and education.

In 1970, about 21.9 million workers were employed in service industries. Approximately one-half were wage and salary workers employed by private firms, 6.3 million were government employees (mainly in educational and medical services), and 2.1 million were self-employed persons. The remainder, accounting for 1.8 million persons, were employed in private households.

Educational services, including public and private elementary and secondary schools and institutions of higher education, make up the largest sector of the service industry and account for nearly one-third of its work force. Hospitals and other establishments that provide health services constitute the next largest sector, and account for one-fifth of the workers. In both of these service industries, government workers (mainly local and State) make up a large share of the work force. Other service industries employing many workers are hotels, laundries, and other personal services, private households, business and repair services, and entertainment.

In 1970, women accounted for about three-fifths of total employment in the service industry. Their employment ranged from less than one-tenth of total employment in automobile and other repair businesses to nine-tenths in private households. Women workers also accounted for an especially high proportion of total employment in hospitals, educational services, hotels, and establishments that provide personal services such as beauty shops and laundries.

In 1970, as shown in the accompanying tabulation, white-collar workers (professional, managerial, clerical, and sales workers) accounted for nearly three-fifths of the service industry's employment. The industry employs the highest proportion of professional, technical, and kindred workers of any major industry and they account for over one-third of the industry's employment. By far the largest concentration of professional personnel is represented by teachers employed in educational services. Other major employers are medical and health services—where doctors, dentists, and nurses constitute a large share of the work force, and professional services where large numbers of lawyers, accountants, engineers, and architects are employed. Self-employment is typical for most male professional workers in health services. By comparison, women in this field—typified by registered nurses—mainly are salaried workers. Clerical workers account for 1 out of 6 service industry employees. Most of them are stenographers, typists, secretaries, and office machine operators. Managers, officials, and proprietors, including hospital administrators, make up a relatively small fraction of the industry's employment.

Service workers represent nearly one-third of the industry's employment. The major service occupations are private household worker, practical nurse, hospital attendant, charwoman, janitor, waiter, waitress, cook, and protective service worker.

Blue-collar workers, mainly skilled craftsmen and semiskilled workers (operatives), constitute only one-eighth of the industry's employment. Many of the craftsmen are employed as mechanics in automobile and other repair service industries or as maintenance workers in hotels, schools, and other establishments. Motion picture projectionists are especially important in the entertainment industry. Operatives are employed mainly in laundries, auto repair shops, and other types of repair businesses. Most of the relatively few laborers in this industry work in auto repair shops, on golf courses, and in bowling alleys.

Major occupational group	*Estimated employment, 1970 (percent distribution)*
All occupational groups	100
Professional, technical, and kindred workers	35
Managers, officials, and proprietors	6
Clerical and kindred workers	16
Salesworkers	1
Craftsmen, foremen, and kindred workers	5
Operatives and kindred workers	5
Service Workers	31
Laborers	2

NOTE: Because of rounding, individual items may not add to total.

Employment in the service industry is expected to increase rapidly through the 1970's. Major factors contributing to the sharp growth in the demand for services are expected to stem from population growth, expanding business activity, rising personal incomes, and the general awareness of the benefits that educational, health, and other services can provide. The fastest growing components of the service industry will be educational services, medical health services, and among firms that provide computer services and laboratory research facilities.

The necessity for extensive person-to-person contact in the many service functions tends to limit the effect of technological innovations on employment requirements. Although automatic data-processing equipment may moderate growth in some areas—for example, in accounting and bookkeeping—technological change is not expected to limit the demand for workers in the service industry.

The statements that follow discuss job opportunities in the hotel and laundry and drycleaning industries. More detailed information about occupations that cut across many industries appears elsewhere in the *Handbook*. (See index in the back of the book.)

HOTEL OCCUPATIONS

Throughout the United States, hotels and motels provide travelers with a "home-away-from-home." More than 870,000 people worked in hotels and motels in 1970. The great majority were employed in hotels and motor hotels located chiefly in urban areas. The remainder worked in motels and tourists courts located on the outskirts of large cities, along major highways, and in resort areas. About one-half of the employees in hotels and related businesses are women.

Some hotel occupations can be entered with little or no specialized training. In many kinds of hotel work, however, the demand for specially trained people is increasing. Hotels are complex organizations and need specialized personnel to direct and coordinate operations which may involve thousands of guests annually and millions of dollars of property and equipment.

This chapter deals with employment opportunities in hotels and motels, and includes separate statements on several hotel occupations.

The Hotel Business and its Workers

Hotels are of three general types —commercial, residential, and resort. The vast majority are commercial hotels, which cater chiefly to travelers seeking a room for a brief stay. A small number are residential hotels, which generally accommodate people for long periods, ranging from a few months to many years. Others are resort hotels, which provide lodging for vacationers. Motor hotels, motels, and tourist courts also cater to vacationers and other travelers seeking accommodations for a short time. Commercial and residential hotels generally operate the year round. Although some resort hotels, motor hotels, and motels are open for only part of the year—for example, during the winter season in Florida or the summer months in northern parts of the country—an increasing number are remaining open the full year.

Hotels range in size from those which have fewer than 25 rooms and only a few employees to some which have 1,000 rooms or more and many hundreds of workers. Many of the motor hotels built in recent years have large staffs. Many motels, however, are relatively small, including a sizable number which are run by the owners with few, if any, paid employees.

Most hotels have restaurants, ranging from simple coffee shops to vast dining rooms, with wine cellars and elaborate kitchens. Large hotels and motor hotels also may have banquet rooms, exhibit halls, and spacious ballrooms. Many hotels and motels, especially in resort areas, have recreational facilities such as swimming pools, boating facilities, golf courses, and tennis courts. Hotels also may provide information about interesting places to visit, sell tickets to theaters and sporting events, and even call in babysitters. Their facilities often include newsstands, gift shops, barber and beauty shops, laundry and valet services, and railroad and airline ticket reservation offices. Although motels and tourist courts usually offer fewer services than hotels, the number with restaurants, swimming pools, and other conveniences for guests is steadily increasing.

Because of the many services they offer, hotels need workers in a wide variety of occupations. One of the largest groups of hotel employees is in the housekeeping department. Many thousands of maids, porters, housemen, linen room attendants, and laundry room workers are employed by hotels and motels to make beds, clean rooms and halls, move furniture, hang draperies, provide guests with fresh linens and towels, operate laundry equipment, and mark and inspect laundered items. Women usually are employed for the lighter housekeeping tasks, whereas men have jobs requiring more strenuous physical effort such as washing walls and arranging furniture. Large hotels and motor hotels usually employ executive housekeepers to supervise these workers, and some hotels also may have a special manager in charge of laundry operations.

In most hotels, a uniformed staff performs guest services in the lobby. This staff includes the bellmen who carry baggage for guests and escort them to their rooms. Doormen are also a part of the uniformed staff, as are elevator operators.

The front office staff work as room clerks, key clerks, mail clerks, and information clerks. Their chief duties are to greet guests, assign rooms, and furnish information. More than half of the hotel clerical workers are front office employees. The remainder, mainly women, are employed in a variety of office occupations such as bookkeeper, cashier, telephone operator, and secretary. These occupations are discussed elsewhere in the *Handbook*.

Hotel managers and their assistants have the highly important task of supervising operations and making them profitable. A general manager is in charge of all hotel operations. Some general managers have assistants in charge of various phases of hotel management. Some assistants may be responsible for specific operations; for example, food-service managers operate the dining rooms and other eating facilities, and sales managers are responsible for attracting more business to hotels and motels.

In addition, hotels also employ workers who are found in other industries. Among these are accountants, personnel workers, entertainers, recreation workers, waiters, chefs, and bartenders. Maintenance workers, such as carpenters, electricians, stationary engineers, plumbers, and painters, also work for hotels. Still other types of workers employed in hotels include detectives, barbers, beauty salon operators, valets, seamstresses, and gardeners. Most of these occupations are discussed elsewhere in the *Handbook*.

Employment Outlook

A rapid increase in employment is likely in this industry through the 1970's. In addition, thousands of workers will be required each year to replace those who retire or die. Other openings will result from the need to replace workers who transfer to positions in other industries.

Most of the anticipated employment growth in the industry will stem from the need to staff the new hotels, motor hotels, and motels being built in urban areas, as well as the additional facilities being built in resort areas. Limited expansion will take place in older hotels that try to meet the challenge of increasing competition for business by modernizing their facilities and expanding their services. Hotels that are unable to modernize their facilities are likely to experience low occupancy rates and may be forced to reduce overhead costs by eliminating services and workers. Thousands of temporary jobs will continue to be available each year in resort hotels, motels, and other establishments which are open only part of the year or have more business in some seasons than others.

The demand for lodging is expected to increase through the 1970's as the country's population grows and travel for business and pleasure increases. Jet air travel, which permits businessmen and others who travel frequently to make a trip to a distant city, complete their business, and return home the same day, may somewhat limit this increase. Employment is likely to rise most rapidly in motels and motor hotels catering to motorists. This trend has been evident for some time and will continue, as the Federal highway building program further stimulates both automobile travel and the building of motels and motor hotels. In motels, most of the additional employees will be housekeeping and food-service workers.

Most of the job openings in hotels will continue to be for workers who need little specialized training such as maids, porters, housemen, and some dining room employees. These jobs account for a large proportion of all hotel workers and have high turnover rates. When general employment conditions are good, people in these jobs find it relatively easy to shift to other kinds of work. Also, many of the workers are women, who often leave their jobs to care for their families. In a few of these occupations, technological changes may limit the number of openings. For example, the increased use of automatic dishwashers, vegetable cutters and peelers, and other mechanical kitchen equipment is likely to reduce the need for kitchen helpers.

A number of people also will be needed every year in front office jobs to replace workers who are promoted to managerial posts, as well as to fill new jobs in the increasing number of hotels and motels. People in these occupations are less subject than many other workers in the industry to changes in general economic conditions. In addition, there will be openings for other clerical workers, although the increasing use of office machines may affect adversely clerical employment in some hotels. Opportunities are expected to be favorable for young people who acquire the training and experience necessary to qualify for jobs as cooks and food managers. (Food service workers and office workers are discussed elsewhere in the *Handbook*.)

Earnings and Working Conditions

The location, size, and type of hotel affect earnings of hotel workers. Other significant factors include the tipping practice for the occupation and the degree of unionization. About one-half of all hotel workers are now covered by the Fair Labor Standards Act, a Federal statute which sets minimum wages. In 1970, hotel workers covered by the law received at least $1.60 an hour, non-tipped employees receiving $1.60 an hour in wages; and tipped employees earning at least 80 cents an hour in tips, receiving 80 cents an hour in wages. In addition, more than half the States have their own wage and hour laws that cover hotel workers.

Salaries of hotel employees in managerial positions have an especially wide range, mainly because of great differences in duties and responsibilities. Hotel manager trainees who are graduates of specialized college programs start at yearly salaries ranging from $8,000 to

$12,000 and are usually given periodic increases for the first year or two. Experienced managers may earn several times as much as beginners; a few, in top jobs, earn $50,000 a year or more. In addition to salary, hotels customarily furnish managers and their families with lodging in the hotel, meals, parking facilities, laundry, and other services.

Wage rates of nonsupervisory hotel workers vary greatly from occupation to occupation and in different parts of the country. For example, nonsupervisory hotel workers in the Western part of the United States usually have higher hourly earnings than those working in the South. In addition to regular earnings, bellmen, maids, and housekeepers may receive tips from hotel or motel guests. According to a recent Bureau of Labor Statistics survey that included larger hotels and motels, earnings of bellmen averaged $1.18 an hour. Practically all bellmen surveyed were classified as tipped employees, receiving more than $20 a month in tips.

Since hotels are open round the clock, workers may be employed on any one of three shifts. Usually, more people are employed during the day than at night, and additional compensation may be paid for work during late hours. Managers and housekeepers who live in the hotel usually have regular work schedules, although managers may be called on at any time.

Waiters and waitresses, cooks, pantry workers, dishwashers, and other kitchen workers commonly receive meals; in a few hotels, maids, elevator operators, and room clerks also receive meals. Most nonsupervisory employees are covered by paid vacation provisions, the duration of the vacation usually being determined by length of service. Paid holidays—ranging from 1 to 8 days a year—are provided for about half of the nonsupervisory hotel employees.

The Hotel & Restaurant Employees and Bartenders International Union is the major union in the hotel business. Uniformed personnel, such as bellmen and elevator operators, may be members of the Building Service Employees' International Union.

Sources of Additional Information

Information on careers in hotel work may be obtained from:

American Hotel and Motel Association, 888 7th Avenue, New York, N.Y. 10019.

Additional information on hotel training opportunities and a directory of schools and colleges offering courses and scholarships in the hotel field may be obtained by writing to:

Council on Hotel, Restaurant, and Institutional Education, 1522 K Street NW., Washington, D.C. 20005.

Information on housekeeping in hotels, including a list of schools offering courses in housekeeping, may be obtained from:

National Executive Housekeepers Association, Inc., Business and Professional Building, Gallipolis, Ohio 45631.

BELLMEN AND BELL CAPTAINS

(D.O.T. 324.138 and .878)

Nature of the Work

Bellmen, also called *bellboys* or *bellhops,* carry the baggage of incoming hotel guests while escorting them to their rooms. The bellman checks to see that everything is in order in the room. He may suggest the use of various hotel services, including the dining room and valet service. Bellmen also handle room service, perform errands, and deliver packages. In 1970, more than 30,000 such workers were employed in the Nation's lodging

places. In large hotels, special baggage porters usually carry baggage for guests who are checking out. In smaller hotels, bellmen carry baggage for outgoing as well as incoming guests, and also may relieve the elevator operator or switchboard operator.

Bell captains are employed in large and medium-size hotels to supervise the bellmen. They assign work, keep time records, and instruct new bellmen in their duties. They also may give guests transportation information and send a baggage porter or a bellman to pick up the tickets. In addition, they handle complaints from guests regarding the work of their department, and take care of requests for unusual services. At times, bell captains also may perform the duties of bellmen.

Superintendents of service—found in only a few hotels with large service departments—supervise elevator operators, doormen, and washroom attendants, as well as bellmen and bell captains.

Training, Other Qualifications, and Advancement

No specific educational requirements exist for bellman jobs. Graduation from high school, however, enhances a bellman's opportunities for promotion to front office clerical jobs. (See statement on Front Office Clerks in this chapter.)

In many hotels, bellman jobs are filled by promoting elevator operators. In the service department of the hotel, the line of promotion is from bellman to bell captain to superintendent of service. Some of the factors which may affect a bellman's chances for advancement are a favorable work record showing few complaints by guests, good work habits, initiative, and leadership qualities. Since there is only one bell captain position in each hotel, a number of years may pass before an opening occurs. Opportunities for advancement to superintendent of service are even more limited.

Since bellmen are in frequent contact with the public, it is important that they be neat, tactful, and courteous. A knowledge of the attractions and geography of the local community is an asset. They also must be able to stand for long periods and to carry heavy baggage.

Employment Outlook

Nearly a thousand openings for bellmen are expected each year through the 1970's, due to growth, deaths, and retirements. Many additional openings also will be created as bellmen transfer to other occupations. Since many hotels promote from within by advancing men elevator operators to bellman jobs, chances for outsiders to enter year-round jobs as bellmen will be best in hotels which employ women as elevator operators, and in the increasing number of hotels which have automatic elevators. Many opportunities for temporary jobs also will arise in resort hotels which are open only part of the year and hire college students and other young men. Beginners also will be needed in small hotels to replace experienced bellmen who shift to jobs in luxury hotels where earnings from tips may be higher. Competition among employed bellmen for the relatively few bell captain jobs that will become available in the future is expected to remain keen.

The number of bellmen employed is expected to increase slowly through the 1970's. Some additional jobs will be created as new hotels and motor hotels are built, and additions are made to existing hotels. The fast growing motel business also will provide some additional jobs; however, because of the type of construction and the emphasis on informality, relatively few motels employ bellmen.

See introductory section to this chapter for information on Earnings and Working Conditions, Sources of Additional Information, and for additional information on Employment Outlook.

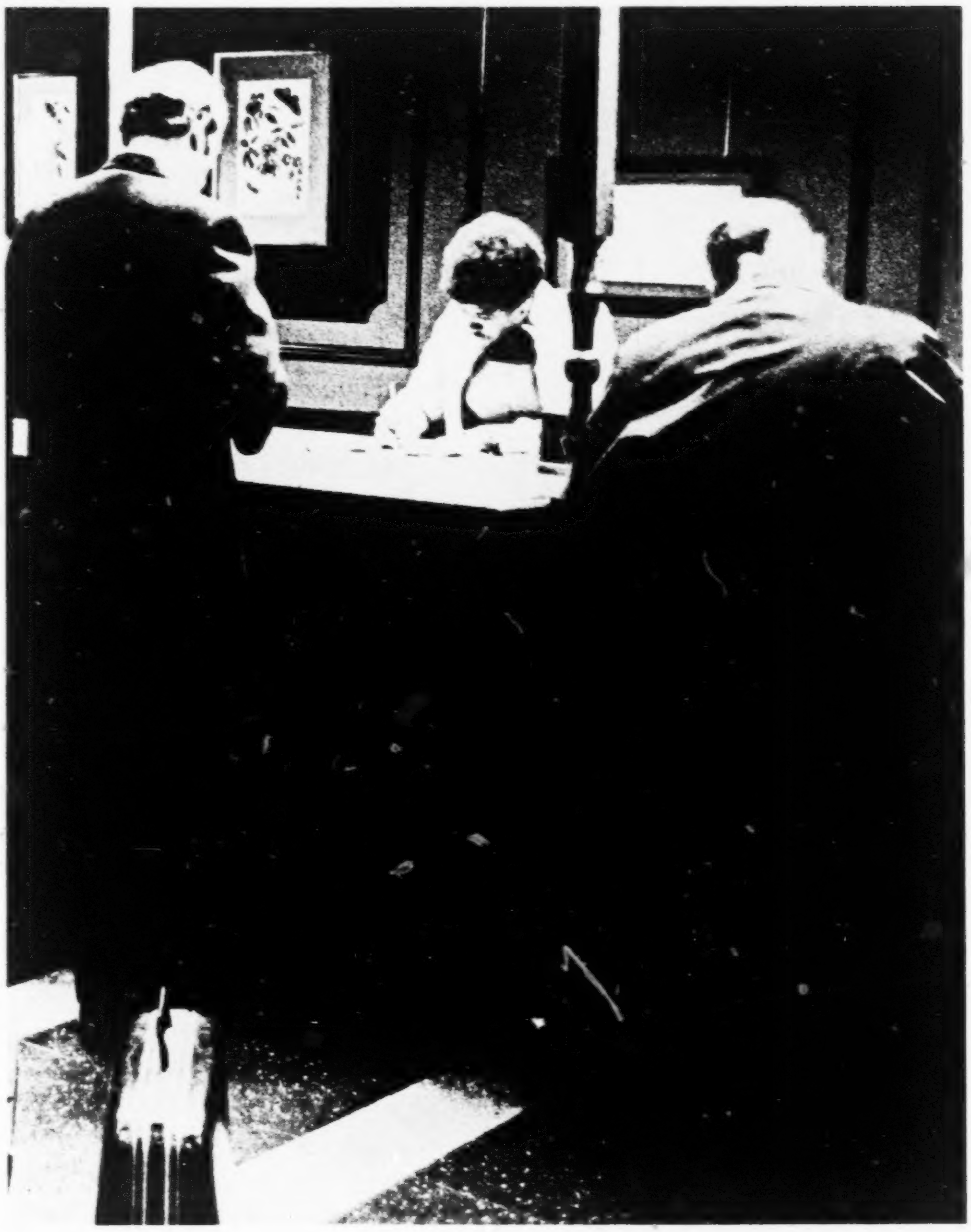
FRONT OFFICE CLERKS

(D.O.T. 242.368)

Nature of the Work

Hotels and motels employ front office clerks to rent the rooms and perform related operations. These include greeting the guests, issuing keys, and handling mail. More than 60,000 such workers were employed in the Nation's lodging places in 1970. By working "up front," they deal directly with the public and help build an establishment's reputation for courteous and efficient service. In small hotels and in many motels, a front office clerk (who may be the owner) may also do some bookkeeping and act as cashier or telephone operator. On the other hand, large hotels usually employ several front office clerks, who may be assigned to different kinds of jobs.

Room or desk clerks rent the available rooms. Customarily, they are the first of the front office clerical staff to greet guests. In assigning rooms, they must be aware of advance registrations, consider any preferences guests may express, and



at the same time try to obtain maximum revenues for the hotel. These clerks give information about rates and the types of services available, and see that guests fill out registration forms properly. After registration is completed, room clerks signal bellmen to carry guests' luggage. *Reservation clerks* acknowledge room reservations, type out registration forms, and notify the room clerk when guests are due to arrive. To keep room assignment records current, *rack clerks* insert or remove forms indicating the time when rooms become occupied or vacant, or when they are closed for repairs. They also keep housekeepers, telephone operators, and other personnel informed about changes in room occupancy. Other special clerks, such as *key, mail, and information clerks,* are employed in some large hotels. In the largest hotels, *floor supervisors or floor clerks* are assigned to each floor to handle the distribution of mail and packages and perform other incidental duties.

In all but the largest hotels and motels, front office clerks may be responsible for a combination of these various duties. They may have other duties as well, particularly when they work on late evening shifts. For example, the night room clerk may perform bookkeeping functions or assist cashiers with their clerical work.

Training, Other Qualifications, and Advancement

High school graduates who have some clerical aptitude and the personal characteristics necessary for dealing with the public may be hired for beginning jobs as mail, information, or key clerks. Neatness, a courteous and friendly manner, and ease in dealing with people are important personal traits for front office clerks. Typing and bookkeeping courses given in high school may be helpful, particularly for nightshift work where additional clerical duties often are performed, or for jobs in smaller hotels and motels, where the front office clerks often have a variety of duties. Although education beyond high school generally is not required for front office work, hotel employers are attaching greater importance to college training in selecting personnel who may be advanced later to managerial positions. Front office clerks may improve their opportunities for promotion by taking home study courses, such as those sponsored by the Educational Institute of the American Hotel and Motel Association.

Inexperienced workers learn about the front office routine mainly through on-the-job experience. They usually have a brief initial training period during which their duties are described, and they are given information about the hotel, such as the location of rooms and the types of services offered. After new employees begin working, they receive help from the assistant manager or some experienced front office worker.

Front office workers usually start as key clerks or mail clerks, or in other fairly routine jobs. Occasionally, employees in other types of related work—for example, bellmen or elevator operators—may be transferred to front office jobs. Most hotels have a promotion-from-within policy for front office workers. A typical line of promotion might be from key or rack clerk to room clerk, to assistant front office manager, and later to front officer manager. (See statement on Hotel Managers and Assistants in this chapter.)

Employment Outlook

Employment in this occupation is expected to increase rapidly through the 1970's. Many openings will result from the need to replace workers who are promoted to higher level jobs or transfer to other occupations. In addition, new front office jobs will be created in the hundreds of hotels, motels, and motor hotels expected to open or expand in the next decade.

A front office clerk has relatively stable employment. Employment in this occupation does not contract as sharply with changes in general economic conditions as does employment in many other hotel occupations. However, the introduction of computerized reservation systems may change the duties of some front office clerks.

See the introductory section to this chapter for information on Earnings and Working Conditions, Sources of Additional Information, and for additional information on Employment Outlook.

HOTEL HOUSEKEEPERS AND ASSISTANTS

(D.O.T. 321.138)

Nature of the Work

Hotel housekeepers are responsible for keeping hotels clean and attractive. They account for furnishings and supplies; and hire, train, and supervise the maids, linen and laundry workers, housemen, seamstresses, and repairmen. In addition, they keep employee records and perform other duties which vary by size and type of hotel. Those employed in middle-size and small hotels not only supervise the cleaning staffs but also may do some of their work. In large hotels and smaller luxury-type hotels, the duties of executive or head housekeepers are primarily administrative. Besides supervising a staff which may number in the hundreds, they prepare the budget for the housekeeping department; make regular reports to the manager on the condition of rooms, needed repairs, and suggested improvements; purchase or assist in purchasing supplies; and have responsibility for interior decorating work. Some executive housekeepers employed by large hotel chains may have special assignments such as reorganizing housekeeping procedures in an established hotel or setting up the

Housekeepers check linen supplies.

housekeeping department in a new or newly acquired hotel.

In many hotels, executive housekeepers are assisted by floor housekeepers who supervise the work on one or more floors. Large hotels also may employ assistant executive housekeepers. More than 30,000 hotel housekeepers were employed in 1970, most of them women.

Training, Other Qualifications, and Advancement

Although no specific educational requirements exist for housekeepers, most employers prefer applicants who have at least a high school diploma. Experience is also an asset in obtaining a hotel housekeeping job.

Specialized training in hotel administration, including courses in housekeeping, was available at several colleges in 1970. Some universities offer short summer courses or conduct evening classes in cooperation with the National Executive Housekeepers Association. In addition, the Educational Institute of the American Hotel and Motel Association also offers housekeeping oriented courses for class or individual home study. The most helpful courses are those emphasizing housekeeping procedures, personnel management, budget preparation, interior decorating, and the purchase, use, and care of different types of equipment and fabrics.

Employment Outlook

Several thousand openings for hotel housekeepers and their assistants are expected annually through the 1970's. Some openings will result from the need to replace workers who retire or leave the occupation for other reasons. However, many new positions for housekeepers will become available in newly built hotels and the growing number of large motor hotels and luxury motels. In established hotels, most openings for assistant housekeepers will be filled from within by promoting maids. Similarly, vacancies for executive housekeepers often will be filled by promoting assistant housekeepers. However, since only one top job as executive housekeeper exists in each hotel, many years may pass before an opening of this kind occurs in a given hotel. Experienced hotel housekeepers also will find employment opportunities in hospitals, clubs, college dormitories, and a variety of welfare institutions.

See introduction to this chapter for information on Earnings and Working Conditions, Sources of Additional Information, and for additional information on Employment Outlook.

HOTEL MANAGERS AND ASSISTANTS

(D.O.T. 163.118 and 187.118 and .168)

Nature of the Work

Hotel and motel managers are responsible for operating their establishments profitably and, at the same time, providing maximum comfort for their guests. Of the more than 190,000 hotel and motel managers employed in 1970, about 90,000 were salaried and more than 100,000 were owner-managers. Managers direct and coordinate the activities of the front office, kitchen, dining rooms, and the various hotel departments, such as housekeeping, accounting, personnel, purchasing, publicity, and maintenance. They make decisions on room rates, establish credit policy, and have final responsibility for dealing with many other kinds of problems that arise in operating their hotels or motels. Like other managers of business enterprises, they also may spend considerable time conferring with business and social groups and participating in community affairs.

Manager checks convention reservations.

In small hotels, the manager also may perform much of the front office clerical work. In the smallest hotels and in many motels, the owners—sometimes a family team—do all the work necessary to operate the business.

The general manager of a large hotel may have several assistants who manage one department or more and assume general administrative responsibility when the manager is absent. Because preparing and serving food is important in the operation of most large hotels, a special manager usually is in charge of this department. Managers of large hotels usually employ a special assistant, known as a sales manager, whose job is to promote maximum use of hotel facilities. The sales manager spends much time advertising the facilities his hotel can offer for meetings, banquets, and conventions.

Since large hotel chains often centralize activities such as purchasing supplies and equipment and planning employee training programs, managers in these hotels may have fewer duties than managers of independently owned hotels. Hotel chains may assign managers to help organize work in a newly acquired hotel, or may transfer them to established hotels in different cities or in foreign countries.

Training, Other Qualifications, and Advancement

Since most hotels promote from within, individuals who have proven their ability, usually in front office jobs, may be promoted to assistant manager positions and eventually to general manager.

Although successful hotel experience is generally the first consideration in selecting managers, employers increasingly emphasize a college education. Many believe the best educational preparation is provided by colleges offering a specialized 4-year curriculum in hotel and restaurant administration. Specialized courses in hotel work, available in a few junior colleges, and study courses given by the Educational Institute of the American Hotel and Motel Association are also helpful.

In colleges offering a specialized 4-year curriculum in hotel management, the courses include hotel administration, hotel accounting, economics, food service management and catering, and hotel maintenance engineering. Students are encouraged to spend their summer vacations working in hotel or restaurant jobs. The experience gained in these jobs and the contacts with employers may enable young people to obtain better hotel positions after graduation. In addition, students are encouraged to study foreign languages and other subjects of cultural value such as history, philosophy, and literature.

College graduates who have majored in hotel administration usually begin their hotel careers as front office clerks; after acquiring the necessary experience, they may advance to top managerial positions. An increasing number of employers require some experience in food operations. Hotel chains may offer better opportunities for advancement than independent hotels, since vacancies may arise in any hotel of the chain, as well as on the central management staff.

Some large hotel organizations have established special programs for management trainees who are college graduates or for less highly trained personnel promoted from within. These programs consist mainly of on-the-job training assignments in which the trainee is rotated among jobs in the various hotel departments. Some large hotels provide financial assistance to outstanding employees for college study.

Employment Outlook

Well-qualified young people will find favorable opportunities through the 1970's to obtain entry positions that offer the possibility of promotion to managerial work. Young applicants who have college degrees in hotel administration will have an advantage in seeking entry positions and later advancement. Many openings for management personnel also will result from the need to fill vacancies resulting from turnover.

The number of hotel managers is expected to increase moderately during the 1970's. New positions will arise as additional hotels are built, and as the number of motor hotels and luxury motels expands.

See the introductory section of this chapter for information on Earnings and Working Conditions, Sources of Additional Information, and for additional information on Employment Outlook.

OCCUPATIONS IN LAUNDRY AND DRYCLEANING PLANTS

In 1970, approximately 630,000 persons were engaged in laundering and drycleaning garments, household furnishings, and institutional linens and uniforms. These workers are located in every State, in every city, and probably in every neighborhood. About two-thirds of them are women.

Drycleaning firms accounted for more than 40 percent of the industry's workers, and laundries (including coin-operated laundromats) accounted for another 35 percent. Most of the remainder worked for firms that specialized in renting and cleaning uniforms, towels, diapers, and similar items. A small proportion of the total were employed in valet shops.

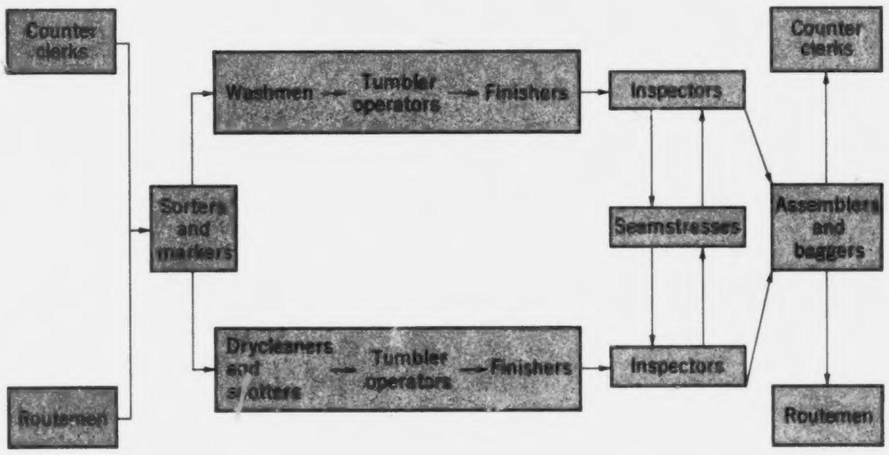
Most employment is concentrated in firms that have 20 or more employees. Many firms, however, are owner-operated and have only a few employees. In 1970, about one-seventh of the industry's workers were self-employed.

Nature of the Work

One way to describe the work done in this industry is to follow an imaginary bundle of clothes through the plant. (See chart 36.) The bundle consists of some men's shirts, a business suit, and bed linens. A *route salesman or driver* (D.O.T. 292.358) picks up the bundle and leaving a receipt, takes the bundle to the plant. After the items have been cleaned, the route salesman delivers them and collects payment; or the owner of the bundle may instead leave them at the plant or drive-up store. In this case, a *counter clerk* (D.O.T. 369.887) makes out a receipt and turns the bundle over to a marker. Either the routeman or the counter clerk sorts the items in the bundle into laundry and dry cleaning.

The bundle is turned over to *markers* (D.O.T. 369.887), who put an identifying symbol on each item so it may be matched with the customer's receipt at some later time. The markers then send the shirts and sheets to the washroom and the suit to the drycleaning room.

㊱ How work flows through a laundry and drycleaning plant



SOURCE: BUREAU OF LABOR STATISTICS

A *washman* (D.O.T. 361.885) puts several hundred pounds of sheets in a huge washing machine. Likewise, he loads shirts in another washer. These machines are controlled automatically, but the washman must understand how to operate the controls—water temperature, suds level, time cycles, additives, and the amount of agitation for different fabrics. When the washing cycle is completed, the laundry is transferred to an extractor that removes about half the water. This stage is similar to the "spin" cycle on a home washer. Conveyors move the laundry to conditioners, dryers, or tumblers where dry, heated air removes some of the remaining moisture.

The sheets go from the drying area to *flatwork finishers* (D.O.T. 363.886) who shake out folds and creases, spread the sheets on moving belts, and feed them into large flatwork ironing machines for ironing and partial folding. When the sheets come out of the machine, other finishers complete the folding and stacking.

Shirts go directly from the extractor to *shirt finishers* (D.O.T. 363.782) who usually work in teams of two or three. One finisher puts the sleeves of the shirt on two armlike forms called a "sleever." A second operator then puts the shirt on a "triple-head" press that irons the collar and two cuffs at the same time. She then puts the shirt on a "bosom" press that irons the front and back simultaneously. The first finisher either folds the shirt or places it on a hanger, whichever the customer prefers. A third finisher may do the folding. In some laundries, one shirt finisher performs all these operations.

Counter clerk prepares customer's receipt.

Washman empties washer load into bins.

The jobs of the *drycleaner* (D.O.T. 362.782) and washman are similar, but the cleaning solution for drycleaning is a chemical solvent instead of water, and the machine holds only 30–100 pounds. The drycleaner sorts the clothes according to color, fiber content, and fabric construction and selects the proper time cycle for each load. He may apply special solutions called "reagents" to spots and stains before placing the garments in the drycleaning machine. After cleaning, he transfers the clothes to an extractor to remove the solvent, and then places them in a tumbler or hot-air cabinet to dry. The *spotter* (D.O.T. 362.381) will use chemical reagents and steam to remove stubborn stains.

Men's suit finisher sprays jacket.

A *men's suit finisher* (D.O.T. 363.782) puts the pants on a special "topper and legger" press. The jacket is placed on a body form that may have a second part that comes down to press and shape the shoulders and collar of the jacket while the steam is forced from the inside. Final finishing touches are done on a steam heated pressing head and "buck," a flat surface covered in fabric.

An *inspector* (D.O.T. 369.687)

checks finished items to see that the quality standards of the plant have been maintained. Any item in need of recleaning or refinishing may be returned to the appropriate department. Occasionally, she may work on them herself. Repair work may be forwarded to a *seamstress* (D.O.T. 782.884) who sews on buttons, mends tears, and resews seams. Finally, *assemblers* (D.O.T. 369.687) collect the linens and shirts by matching the sales invoice with the identification marks. Another assembler does the same with the suit. Either they or *baggers* (D.O.T. 920.887) may remove tags before putting the items in bags or boxes for storage until called for or delivered.

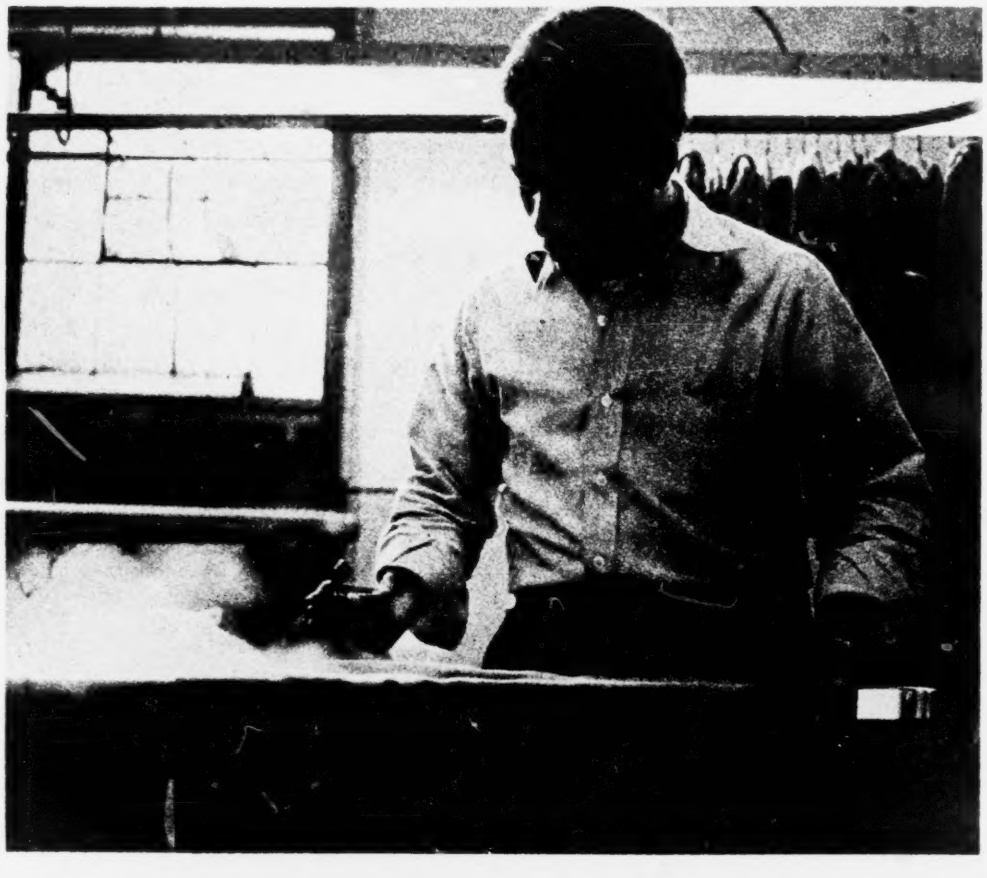
Bagger collects and bags customer's clothes.

Many other workers are found in laundry and drycleaning plants. A manager or proprietor is responsible for seeing that the work of the plant is performed efficiently. Office workers keep records, handle correspondence, and prepare bills. Sales personnel develop new customers for the plant's services. Foremen supervise production workers in the plant. Mechanics and repairmen keep equipment and machinery operating properly. Some service workers clean, guard, and otherwise maintain the plant; others plan and serve food to plant workers. Laborers lift and carry heavy loads to machines. (Discussion of many of these occupations can be found elsewhere in the *Handbook*.)

Training, Other Qualifications, and Advancement

Many workers in this industry get their first jobs without previous training. Basic laundry and drycleaning skills may be learned on the job in a short time. Some jobs such as folding towels and feeding pillowcases and sheets into a flatwork ironer may require only 1 or 2 days to learn. Other jobs, such as counter clerk, marker, inspector, and assembler, may require several weeks to learn. Some finishing jobs —pants presser, shirt finisher—may require less than a week's training. Several months or more are needed to train a drycleaner or a ladies' apparel finisher. Because of the variety of fibers and fabrics, spots and stains, and chemical reagents of which he must have knowledge, a spotter may need 6—12 months to learn his skill.

Some preemployment training in finishing and drycleaning/spotting skills is available in vocational high schools and trade schools. Similar training is available in programs administered by the U.S. Department of Labor under the Manpower Development and Training Act as well as in the Job Opportunities in the



Spotter treats garment with special chemicals and steam.

Business Sector program carried out by the National Alliance of Businessmen. Some Opportunities Industrialization Centers—self-help programs for unemployed and underemployed ghetto youth—sponsor training for these same jobs. Home study courses are available from the National Institute of Drycleaning.

Most people find jobs in laundry and drycleaning plants through newspaper advertisements or friends who work in these plants. Employers look for workers who are dependable and who have good physical stamina, manual dexterity, and keen eyesight. Workers must be able to adjust to the repetition characteristic of many laundry and drycleaning jobs.

Advancement for most workers in this industry is limited. Many remain permanently in the same job. Few supervisory positions are available. Nevertheless, employers occasionally send promising employees to technical or managerial training programs given by the National Institute of Drycleaning in Silver Spring, Md., or by the American Institute of Laundering in Joliet, Ill. Some men's suit finishers become skilled enough on the job to do ladies' apparel finishing. Markers and assemblers interested in finishing work usually are given an opportunity to move up to this job. Foremen and managers frequently are chosen from experienced employees already in the industry. Some drycleaners/spotters establish their own drycleaning plants.

Employment Outlook

Employment in this industry is expected to grow moderately through the 1970's. Additional opportunities will develop as experienced workers retire, die, or transfer to other fields. Retirements and deaths alone will result in many thousands of job openings each year.

The principal reasons for increases in the demand for laundry and drycleaning services will be rising population and incomes. With more people who have more money to spend, demand for personal services will rise. Also, as more women seek careers outside the home, working wives may have the additional income to afford outside services. Offsetting some of the increased demand for laundry and cleaning services resulting from rising population and incomes, will be the easier care of the new fabrics and finishes. Many persons who have not previously laundered at home may consider doing so. However, drycleaning in the home probably will not be practical for many years.

These factors will result in increased employment in all occupations in the laundry and drycleaning industry except route salesmen and spotters. The number of route salesmen probably will decrease as more people take their clothes to the neighborhood plant or drive-up stores for quicker, more economical service. Employment of spotters may decline over the next decade as technological innovations in fibers and finishes make fabrics less stainable.

Earnings and Working Conditions

Wage levels in the laundry and drycleaning industry are not high. However, workers have recently come under the protection of the Federal Minimum Wage Law. Since February 1971, no worker in this industry may be paid less than $1.60 per hour nor work more than 40 hours per week without receiving premium overtime pay, usually 1½ times the base hourly rate. However, many workers receive more than this minimum. In 1970, the hourly average wage for all nonsupervisory workers in this industry was $2.16. Men usually earn more than women, primarily because they predominate in the more highly skilled occupations such as drycleaner, spotter, and washman.

Modern laundry and drycleaning plants are clean and well lighted. Because of the heat, hot air, and steam of the cleaning processes, the plant may be uncomfortably hot during warm months. However, large modern laundries usually have high ceilings—often three stories high—and numerous windows that may be opened for ventilation. Many new, small drycleaning operations are air conditioned in the office and customer areas and air cooled in the machinery areas. In addition, new machinery operates with a minimum of noise.

Sources of Additional Information

The local office of the State employment service may have additional information on training and employment opportunities in this field.

GOVERNMENT

Government service, one of the Nation's largest fields of employment, provided jobs for 12.6 million civilian workers in 1970, about 1 out of 6 persons employed in the United States. Nearly four-fifths of these workers were employed by State or local governments (county, city, town, village, or other local government division); and more than one-fifth worked for the Federal Government, in the continental United States. In addition, a relatively small number of U.S. citizens worked for the Federal government overseas. Rapid growth is expected in State and local government employment, continuing the trend in the post-World War II period. Federal employment is expected to grow slowly. Large numbers of job opportunities will arise in Federal, State, and local governments from the need to replace workers who retire, or die, or leave government service. Hundreds of thousands of individuals will be needed each year for jobs in a wide variety of occupations.

Government employees are a significant part of the nonagricultural work force in every State. Their jobs are found not only in capital cities, county seats, and metropolitan areas, but also in small towns and villages, and even in remote and isolated places such as lighthouse installations and forest ranger stations.

Government Activities and Occupations

Two-fifths of all government workers in 1970 were engaged in providing educational services (chart 37); the majority are in schools and colleges supported by State and local governments. In addition to teachers, employees in this field included administrative and clerical workers, maintenance workers, librarians, dietitians, nurses, and counselors. The great majority of workers in educational services were employed in elementary and secondary schools.

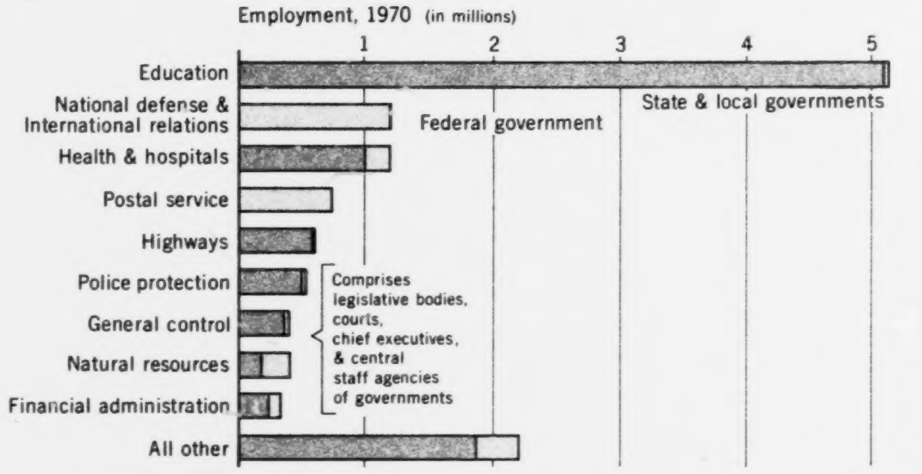
In 1970, 1.2 million government workers were engaged in national defense activities. This number included civilians working in the Department of Defense and a few other defense-related agencies such as the Atomic Energy Commission. Within this group were administrative and clerical employees, doctors, nurses, teachers, engineers, scientists, technicians, and craftsmen and other manual workers. Employees in this group worked in offices, research laboratories, navy yards, arsenals, and missile launching sites, and in hospitals and schools run by the military services.

Another 1.2 million government workers were employed in health services and hospitals. Large concentrations of employees also were found in the postal service, and highway work. Workers were employed also by government agencies in activities such as housing and community development, police and fire protection, social security and public welfare services, transportation and public utilities, conservation of natural resources, tax enforcement and other financial functions, as well as in general administrative, judicial, and legislative activities.

Most employees in the health and hospital fields, in highway work, and in police and fire protection activities worked for State and local government agencies. On the other hand, jobs in national defense and in the postal service were Federal, as were over half the jobs concerned with natural resources, such as those in the National Park and Forest Service.

Although the many different gov-

(37) **Major areas of government employment**



SOURCE: BUREAU OF THE CENSUS

ernmental activities require a diversified work force having many different levels of education, training, and skill, the majority of government employees are white-collar workers.

Among the largest white-collar occupational groups are teachers, administrators, postal clerks, and office workers such as stenographers, typists, and clerks.

Some important occupations and occupational groups among service, craft, and other manual workers are aircraft and automotive mechanics and repairmen; policemen; firemen; truckdrivers; skilled maintenance workers (for example, carpenters, painters, plumbers, and electricians); custodial workers; and laborers.

The wide variety of government functions requires employees in many different occupations. Because of the special character of many government activities, the occupational distribution of employment is very different from that in private industry, as shown in the distributions of employment in 1970 which follows:

	Percent of —	
	Government employment [1]	*Nongovernment employment*
Total	100	100
White-collar workers	66	45
Professional and technical	36	10
Managers, officials, and proprietors	6	12
Clerical	24	16
Sales	([2])	7
Blue-collar workers	16	39
Craftsmen, foremen	7	14
Operatives	5	20
Nonfarm laborers	4	5
Service workers	18	11
Farm workers	([2])	5

[1] Data excluded overseas Federal employment.

[2] Less than 0.5 percent.

NOTE: Because of rounding, sums of individual items may not equal totals.

The following chapters discuss opportunities for civilian employment in the major divisions of government and in the various branches of the Armed Forces. A separate chapter gives information on post office occupations.

FEDERAL CIVILIAN GOVERNMENT

The Federal Government, the largest employer in the United States, had about 2.7 million civilian workers in 1970. In addition, it employed about 60,000 U.S. citizens abroad. Federal employees are engaged in occupations representing nearly every kind of job in private employment, as well as some unique to the Federal Government such as postal clerk, border patrolman, immigration inspector, foreign service officer, and Internal Revenue agent. Practically all Federal employees work for the departments and agencies that make up the executive branch of the government. The others are employed in the legislative and judicial branches.

The executive branch includes the Office of the President, the 11 departments with cabinet representation, and a number of independent agencies, commissions, and boards. This branch is responsible for activities such as administering Federal laws, handling international relations, conserving natural resources, treating and rehabilitating disabled veterans, delivering the mail, conducting scientific research, maintaining the flow of supplies to the Armed Forces, and administering other programs to promote the health and welfare of the people of the United States.

The Department of Defense, which includes the Departments of the Army, Navy, and Air Force, is the largest agency; it employed about 1 million civilian workers in the United States in 1970; the Post Office Department employed about 780,000. The Veterans Administration, the Department of Agriculture, and the Department of Health, Education, and Welfare each had more than 100,000 workers. The remaining employees of the executive branch were distributed among more than 80 departments, agencies, commissions, offices, and boards. There were about 30,000 employees in the legislative branch, which includes the Congress, the Government Printing Office, the General Accounting Office, and the Library of Congress. Almost 7,000 persons were employed by the judicial branch, which includes the Supreme Court and the other U.S. courts.

The Federal Government employs over 2 million white-collar workers, including postal workers. Entrance requirements for white-collar jobs vary widely. Entrants into professional occupations are required to have highly specialized knowledge in a specified field, as evidenced by completion of a prescribed college course of study or, in many cases, the equivalent in experience. Occupations typical of this group are attorney, physicist, and engineer.

Entrants into administrative and managerial occupations usually are not required to have knowledge of a specialized field, but rather, they must indicate by graduation from a 4-year college or by responsible job experience that they have potential for future development. The entrant usually begins at a trainee level and learns the duties of the job after he is hired. Typical jobs in this group are budget analyst, claims examiner, purchasing officer, administrative assistant, and personnel officer.

Technician, clerical, and aid-assistant jobs have entry level positions that usually are filled by persons having a high school education or the equivalent. For many of these positions, no earlier experience or training is required. The entry level position is usually that of trainee, where the duties of the job are learned and skill is improved. Persons having junior college or technical school training or those having specialized skills may enter these occupations at higher levels. Jobs typical of this group are engineering technician, supply clerk, clerk-typist, and nursing assistant.

Because of its wide range of responsibilities, the Federal Government employs white-collar workers in a great many occupational fields. About 150,000 Federal workers are employed in engineering and related fields. Included in this total are about 85,000 engineers, representing virtually every branch and specialty of the profession. There are also large numbers of technician positions in areas such as engineering, electronics, surveying, and drafting. Almost two-thirds of all engineering positions are in the Department of Defense.

Of the 115,000 workers employed in accounting and budgeting work, 33,000 are professional accountants and Internal Revenue agents. Among administrative and managerial occupations in the accounting and budgeting field are tax technician and budget administrator. There are also large numbers of clerical positions involving specialized accounting work. Accounting workers are employed throughout the Government, particularly in the Department of Defense, the Treasury Department, and the General Accounting Office.

More than 90,000 Federal workers are employed in medical, dental, public health, and hospital work. Professional occupations in this field include medical officer, nurse, dietitian, medical technologist, and physical therapist. Among technician and aid jobs are medical technician, medical laboratory aid, and nursing assistant. Employees in this field work primarily in the Veterans Administration; others are in the Defense Department and Department of Health, Education, and Welfare.

About 40,000 workers are employed in the biological and agricultural sciences. Large numbers of professional workers are engaged in forestry and soil conservation work. Others administer farm assistance programs. Technicians and aid-assistant occupations include biology technician, forest and range fire control technician, soil conservation technician, and forestry technician. Most of these workers are employed by the Departments of Agriculture and Interior.

In the physical sciences, the Federal Government employs professional workers such as physicians, chemists, meteorologists, cartographers, and geologists. Aids and technicians in this field include physical science technician, meteorological technician, and cartographic technician. Four-fifths of the 44,000 workers in the physical sciences are employed by the Department of Defense, National Aeronautics and Space Administration, the Department of Agriculture, the Department of Health, Education, and Welfare, and the Commerce Department.

Within the mathematics field are professional mathematicians and statisticians, and mathematics technicians and statistical clerks. There are also a number of administrative positions in the related field of computer programing. Mathematics workers are employed primarily by the Defense Department, the National Aeronautics and Space Administration, the Department of Agriculture, the Commerce Department, and the Department of Health, Education, and Welfare. Positions in the computer field are found in most Federal agencies.

In the field of law are more than 11,000 employees in professional positions, such as attorney, and others in administrative positions such as claims examiner. There are also many clerical positions involving claims examining work. Workers in the legal field are employed throughout the Federal Government.

In the social science field there are professional positions for economists throughout the government; psychologists and social workers, primarily in the Veterans Administration, and foreign affairs and international relations specialists in the Department of State. Among social science administrative workers are social insurance administrators in the Department of Health, Education, and Welfare, and intelligence specialists in the Department of Defense.

The Federal Government employs approximately 60,000 persons in investigating and inspection work. Large numbers of these workers engage in administrative activities such as criminal investigation and food and customs inspection. These jobs are primarily in the Defense, Treasury, Justice, and Agriculture Departments.

Jobs concerned with purchasing, cataloging, storing, and distribution of supplies for the Federal Government provide employment for about 76,000 workers. This field includes many managerial and administrative positions, such as supply management officer, purchasing officer and inventory management specialist, as well as large numbers of specialized clerical positions. Most of these jobs are in the Department of Defense.

Some 450,000 general clerical workers are employed in virtually every department and agency of the Federal Government. Included within this group are office machine operator, secretary, stenographer, clerk-typist, mail and file clerk, telephone operator, and other related workers. In addition, there are several hundred thousand postal clerks employed by the Federal Government.

Blue-collar jobs—service, craft, and manual labor—provided employment to over 540,000 workers in 1970. The majority of these workers were in establishments such as naval shipyards, arsenals, air bases, or army depots; or they worked on construction, harbor, flood-control, irrigation, or reclamation projects. Approximately three-fourths of these workers were employed by the Department of Defense. Others worked for the Veterans Administration, Post Office, General Services Administration, Department of the Interior, Tennessee Valley Authority, and Department of Agriculture. Within this group are a wide range of occupations, including many of the service, craft, and manual occupations found in industry.

The largest single group of blue-collar workers consists of operators and mobile equipment mechanics. Among these jobs are forklift operator, chauffeur, truckdriver, and automobile mechanic. The next largest group of workers are general laborers, who perform a wide variety of manual jobs.

The Federal Government employs many workers in machinery operation and repair occupations, such as boiler and steam plant operator, machinist, machinery repairman, maintenance electrician, electronics equipment repairman, and aircraft mechanic.

Skilled construction workers also are utilized widely throughout the

Federal Government. Included in these fields are jobs such as carpenter, painter, plumber, steamfitter and pipefitter, and sheetmetal worker. Other large blue-collar occupations include warehouseman, food service worker, and printer.

Many skilled occupations may be entered through apprenticeship programs. To qualify, experience normally is not required, but a test may be given to indicate whether an applicant has an aptitude for the occupation. There are also jobs as helpers for skilled workers such as carpenter's helper and machinist's helper.

(Detailed descriptions of the work duties of most white-collar, service, craft, and manual labor jobs mentioned above are provided in other sections of the *Handbook*.)

Federal employees are stationed in all parts of the United States and its territories and in many foreign countries. Although most Government departments and agencies have their headquarters offices in the Washington, D.C. metropolitan area, only 1 out of 9 (about 316,000) Federal workers were employed in that area in 1970. California had more than 300,000 workers, and New York, Pennsylvania, Texas, and Illinois each had more than 100,000. About 39,000 U.S. citizens were employed in foreign countries; and about 21,000 worked in U.S. territories.

The Merit System

Approximately 9 out of 10 jobs in the Federal Government in the United States are covered by the Civil Service Act, which the U.S. Civil Service Commission administers. This act was passed by the Congress to ensure that Federal employees are hired on the basis of individual merit and fitness. It provides for competitive examinations and the selection of new employees from among those who make the highest scores. The Commission, through its network of 65 Civil Service Commission Area Offices is responsible for examining and rating applicants and supplying Federal departments and agencies with names of persons eligible for the jobs to be filled.

Some Federal jobs are excepted from Civil Service requirements either by law or by action of the Civil Service Commission. However, most of the excepted positions are under separate merit systems of other agencies such as the Foreign Service of the Department of State, the Department of Medicine and Surgery of the Veterans Administration, the Federal Bureau of Investigation, the Atomic Energy Commission, and the Tennessee Valley Authority. These agencies establish their own standards for the selection of new employees.

Civil service competitive examinations may be taken by all persons who are citizens of the United States, or who owe permanent allegiance to the United States (in the case of residents of American Samoa). To be eligible for appointment, an applicant must meet minimum age, training, and experience requirements for the particular position. A physical handicap will not in itself bar a person from a position if it does not interfere with his performance of the required duties. Examinations vary according to the types of positions for which they are held. Some examinations include written tests; others do not. Written examinations test the applicant's ability to do the job applied for or his ability to learn how to do it. In nonwritten examinations, applicants are rated on the basis of the experience and training described in their applications and any supporting evidence required.

Applicants are notified as to whether they have achieved eligible or ineligible ratings, and the names of eligible applicants are entered on a list in the order of their scores. When a Federal agency requests names of eligible applicants for a job vacancy, the area office sends the agency the names at the top of the appropriate list. The agency can select any one of the top three available eligibles. Names of those not selected are restored to the list for consideration for other job openings.

Appointments to civil service jobs are made without regard to an applicant's race, color, religion, national origin, politics, or sex.

Employment Trends and Outlook

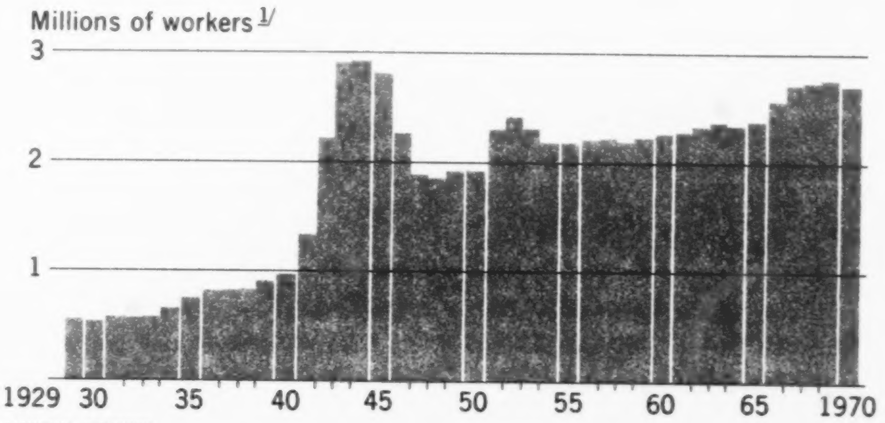
Federal employment is expected to grow at a relatively slow rate during the 1970's.

A number of factors will tend to limit employment in many clerical and blue-collar occupations. Among these factors are the Federal Government's increasing use of laborsaving electronic data-processing and materials-handling equipment and the introduction of improved data-transmission and communications systems.

The manpower requirements of the Federal Government will, in general, tend to reflect the demand for services of an increasing population and the country's domestic and international programs. These demands are expected to be reflected in rapidly rising requirements for professional, administrative, and technical workers.

Population expansion will lead to an increased employment of

㊳ Trends in federal government employment



1/ ANNUAL AVERAGES
SOURCE: BUREAU OF LABOR STATISTICS

workers such as social security claims examiners, accounting and budget workers, and business and industry specialists. Laws providing new or expanded services to the public should result in increased employment of food and drug inspectors, highway engineers, and education personnel. Employment in legal and kindred occupations also may increase mainly because of the existence of more laws and regulations to interpret, administer, and enforce; and more claims to examine for payment of retirement, disability, and death benefits.

Federal employment gains in science, engineering, and other fields will reflect the demands of vigorous national research and development efforts in a variety of programs such as urban development, military weapons, nuclear energy, medicine and health, transportation, and natural resource development. The employment of engineers and engineering technicians will continue to grow rapidly. Employment of scientists, as well as that of technicians working with them, also will increase, and the number of medical personnel employed also should continue to rise.

In addition to new opportunities due to growth in employment, many thousands of job opportunities will become available because of the need to replace employees who transfer out of the Federal service, retire, or die. Thus, many job opportunities will occur in occupations where total employment is relatively stable, as well as in those in which it is rising.

Earnings, Advancement, and Working Conditions

Federal civilian employees are paid under several pay systems.

Pay rates of employees under the General Schedule are set by Congress and are nationwide.

These pay rates are reviewed annually to insure that they are kept comparable with salaries in private industry. This General Schedule provides a pay scale for employees in professional, administrative, technical, and clerical jobs, and for employees such as guards and messengers. General Schedule jobs are classified and arranged in 18 pay grades according to difficulty of the duties, and the responsibilities, knowledge, experience, or skill re-

Distribution of all full-time Federal employees under the General Schedule by grade level, June 30, 1970, and salary scale, effective December 28, 1969

General schedule grade	Employees		Salaries		
	Number	Percent	Entrance	Periodic increases	Maximum
Total	1,286,948	100.0			
1	2,277	.2	$4,125	$134	$5,358
2	24,515	1.9	4,621	154	6,007
3	115,931	9.0	5,212	174	6,778
4	178,068	13.8	5,853	195	7,608
5	158,069	12.3	6,548	218	8,510
6	77,856	6.0	7,294	243	9,481
7	114,420	8.9	8,098	270	10,528
8	25,223	2.0	8,956	299	11,647
9	140,155	10.9	9,881	329	12,842
10	18,067	1.4	10,869	362	14,127
11	147,060	11.4	11,905	397	15,478
12	121,908	9.5	14,192	473	18,449
13	93,135	7.2	16,760	559	21,449
14	43,217	3.4	19,643	655	25,538
15	22,293	1.7	22,885	763	29,752
16	3,391	.3	26,547	885	33,627
17	982	.1	30,714	1,024	34,810
18	381	(1)	35,505	...	....

[1] Less than 0.05 percent.

SOURCE: U.S. Civil Service Commission.

quired. The distribution of Federal white-collar employees by grades, the entrance and maximum salaries, and the amount of periodic increases for each grade are listed in the accompanying table.

Employees in all grades except GS-18 receive within-grade increases after they have completed the required service periods, if their work is determined to be of an acceptable level of competence. Within-grade increases also may be given in recognition of high-quality service.

High school graduates who have no related work experience usually are appointed to GS-2 positions, but some having special skills begin at grade GS-3. Graduates of 2-year junior colleges and technical schools often can begin at the GS-4 level. Most young people appointed to professional and administrative positions enter at grades GS-5 or GS-7, depending on their academic record. Those who have a master's degree or the equivalent in education or experience usually enter at grade GS-7 or GS-9. In addition, the Federal Government also appoints very well-qualified, experienced people at the GS-11 level and above. These appointments are for positions such as psychologist, statistician, economist, writer and editor, budget analyst, accountant, and physicist.

New appointments usually are made at the minimum rate of the salary range for the appropriate grade. However, appointments in hard-to-fill positions frequently are made at a higher rate. For example, in 1970 engineers, accountants, mathematicians, certain physical scientists, and those in a few other specialized occupations were being recruited at above minimum rates.

Advancement depends upon ability, work performance, and generally, upon openings in jobs at higher grades.

Craft, service, and manual workers employed by the Federal Government in the United States are paid under the Coordinated Federal Wage System. The pay rates for these workers are fixed on the basis of "prevailing" rates paid for similar work by private employers in the areas where they work. The accompanying tabulation of regular pay rates for selected occupations illustrates hourly wage rates in 1970.

Employees in agencies with separate merit systems are paid under acts other than those already mentioned.

Many of the occupations found in the Federal Government are discussed in greater detail elsewhere in the *Handbook,* and many include data on earnings in the Federal Government.

The standard workweek for Federal Government employees is 40 hours, and the pay schedules are based on this workweek. If an employee is required to work overtime, he is either paid overtime rates for the additional time worked or given compensatory time off at a later date. Most employees usually work 8 hours a day and 5 days a week, Monday through Friday, but in some cases, the nature of the work may call for a different workweek. Annual earnings for most full-time Federal workers are not affected by seasonal factors.

Federal employees earn 13 days of annual (vacation) leave during each of their first 3 years of service, then 20 days each year until they have completed 15 years; after 15 years, they earn 26 days of leave each year. In addition, they earn 13 days of paid sick leave a year. Nine paid holidays are observed annually. Employees who are members of military reserve organizations also are granted up to 15 days of paid military leave a year for training purposes. A Federal employee who is laid off is entitled to unemployment compensation similar to that provided for employees in private industry.

Other benefits available to most Federal employees include: A contributory retirement system; op-

Coordinated Federal Wage System hourly pay rates, selected occupations and locations, 1970

Location	*Labor (heavy)*	*Electrician*	*Tool, die and guage maker*
Atlanta, Ga	$2.67	$4.31	$5.02
Boston, Mass	3.28	4.18	4.67
Chicago, Ill	3.12	4.40	4.96
Denver, Colo	3.46	4.50	4.95
Norfolk–Portsworth–Newport News–Hampton, Va	2.68	3.93	4.50
Houston–Galveston–Texas City, Texas	3.07	4.42	5.00
Los Angeles, Calif	3.46	4.68	5.20
New Orleans, La	2.75	3.98	4.59
New York, N.Y.	3.07	4.15	4.61
Pensacola, Fla	2.70	4.36	5.07
Philadelphia, Pa	3.41	4.43	4.86
Seattle–Everett–Tacoma, Wash	3.64	4.61	5.03
San Francisco, Calif	3.69	4.95	5.45
St. Louis, Mo	3.58	4.78	5.31
Washington, D.C.	3.10	4.41	5.03

SOURCE: Coordinated Federal Wage System; rates are for the second step of a 3-step pay range.

tional participation in low-cost group life and health insurance programs supported in part by the Government; and training programs to develop maximum job proficiency and help employees achieve their highest potential. These training programs may be conducted in Government facilities or in outside educational facilities at Government expense.

Sources of Additional Information

Information on Federal employment opportunities is available from a number of sources. For college students, the college placement office is often a good source of such information. High school students in many localities may obtain information from their high school guidance counselors. Additional information may be obtained from State employment service offices and many post offices.

The Area Offices operated by the U.S. Civil Service Commission are located in population centers throughout the country. These offices announce and conduct examinations and evaluate and refer eligible applicants to employing agencies for their geographic areas. They also provide a complete one-stop information service so that all interested citizens may learn of local and nationwide employment opportunities in the Federal Government service.

Information about a specific agency also may be obtained by contacting the agency directly.

POST OFFICE OCCUPATIONS

The mailman, carrying the familiar leather pouch over his shoulder, and the clerk, standing behind the stamp window in the Post Office, are the two employees of the Federal Government most familiar to the general public. Although we all receive or send mail almost every day, few people realize how many workers are employed by the Post Office and exactly what they do.

In early 1971, more than 730,000 postal service workers—about 19 percent of whom were women—were employed in 43,000 separate installations throughout the Nation. These workers collected and distributed over 85 billion letters, post cards, newspapers, magazines, parcels, and other items of mail. They also provided special mail services such as registration (giving evidence of mailing and delivery), insurance, and c.o.d. (the collection of the price of an article, and the cost of postage from a customer upon delivery). Other services performed by these workers included selling United States savings stamps and money orders.

Although many postal jobs are located in small communities and in rural areas, postal employment is concentrated in large centers of population. Nearly 73,000 postal service workers, or 10 percent of all post office employees work in the metropolitan area of New York City. Other large centers of postal employment include the Chicago, Los Angeles, Boston, Philadelphia, Washington, D.C., San Francisco, Detroit, and Cleveland metropolitan areas.

The Post Office Department is in the process of being converted to the U.S. Postal Service under the Postal Reorganization Act. (PL-91-375) of August 12, 1970. Rates of pay, hours of work, and other conditions of employment were subject to change at the time this statement was prepared and therefore were excluded. Those desiring timely and accurate information regarding employment in the U.S. Postal Service should contact their local post office.

STATE AND LOCAL GOVERNMENTS

State and local governments provide a very large and growing source of job opportunities in many different occupational fields. In 1970, about 9.9 million workers were employed in State and local government agencies. Almost three-fourths of these workers were with units of local governments, such as counties, municipalities, towns, and school districts, and more than one-fourth were employed in State government agencies.

Nearly 5.3 million employees, or over half of all State and local government workers, were employed in public schools, colleges, or other educational services in 1970.

In addition to almost 3.0 million classroom and college teachers, school systems, colleges, and universities also employ administrative personnel, librarians, guidance counselors, nurses, dieticians, clerks, and maintenance workers. Three-fourths of employment in the field of education is in elementary and secondary schools, which are administered largely by local governments. State employment in education is concentrated chiefly in institutions of higher learning.

The next two largest fields of State and local government employment in 1970 were in health and hospital work and highway work. The 1 million persons employed in health and hospital work include physicians, nurses, medical laboratory technicians, and hospital attendants. More than 600,000 workers were employed in highway activities such as construction and maintenance of roads, highways, city streets, toll turnpikes, bridges, and tunnels. Among these employees are civil engineers, surveyors, operators of construction machinery and equipment, truckdrivers, concrete finishers, carpenters, and construction laborers.

In 1970, more than 600,000 workers were employed in general and financial control activities—most of them at the local level. General and financial control functions include the activities of chief executives and their staffs and legislative bodies; the administration of justice; tax enforcement and other financial work; and general administrative work. These functions require the services of individuals such as lawyers, judges, and other court officials, city managers, property assessors, budget analysts, stenographers, and clerks.

Protective services, such as those provided by police and fire departments, is another large field of State and local government employment. Almost 510,000 people were employed in police work in 1970, principally by local governments. Employment in police work includes administrative, clerical, and custodial personnel, as well as uniformed and plainclothes policemen. All of the 266,000 firemen, many of whom are part-time employees, are employed by local governments.

Other State and local government employees are engaged in a wide variety of fields—local utilities (such as water, electricity, transportation, and gas supply systems); natural resources; public welfare; parks and recreation; sanitation; correction; local libraries; sewage disposal; and housing and urban renewal. These activities require workers in many different occupations such as economist, electrical engineer, electrician, pipefitter, clerk, forester, and busdriver.

Clerical, administrative, maintenance, and custodial workers constitute a significant proportion of all employees in many areas of government activity. Among the larger groups of workers engaged in these occupations are clerk-typists, stenographers, secretaries, office managers, fiscal and budget administrators, bookkeepers, accountants, carpenters, painters, plumbers, guards, and janitors. (Detailed discussions of most occupations in State and local governments are given elsewhere in the *Handbook,* in the sections covering the individual occupations.)

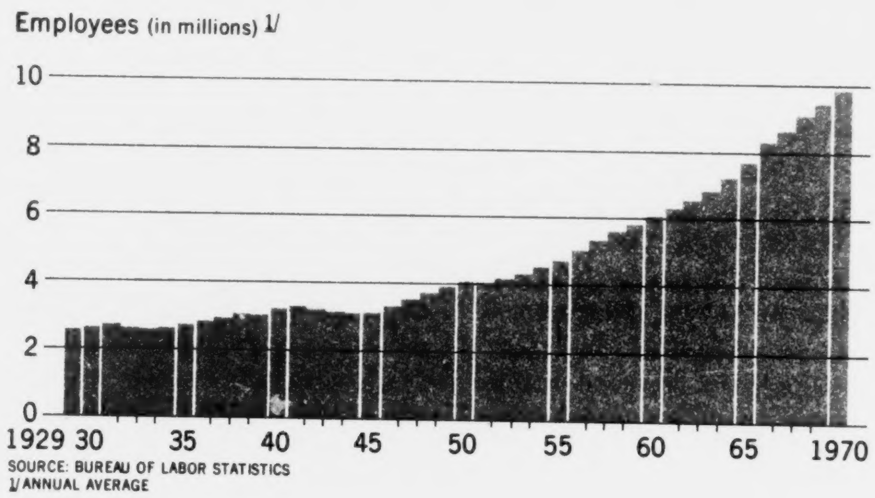
Employment Trends and Outlook

The long-range employment trend in State and local governments has been steadily upward. (See chart 39.) Much of this growth has occurred because of the need to provide services for increasing numbers of younger and older persons, and because of population movements from rural to urban areas. City development has required more street and highway facilities; police and fire protection; and public health, sanitation, welfare, and other services. Population growth and increasing personal income have generated demands for more and improved education, housing, and hospital and other services provided by State and local governments.

Much of the increase in State and local government employment in the 1958–70 period was due to increased employment of teachers and other educational personnel. Expansion in health and hospital services, highway programs, and protective (police and fire) services also contributed to the increase.

Rapid growth in State and local

㊴ Trends in state and local government employment



SOURCE: BUREAU OF LABOR STATISTICS
1/ANNUAL AVERAGE

government employment is expected through the 1970's. Employment of elementary and secondary school teachers, however, is expected to increase more slowly than in the past, as the areas of rapid school enrollment growth shift to higher education. This shift will create greater needs for college and university teachers and administrators.

A larger State and local work force also will be needed to provide improved public transportation systems; more urban planning and renewal programs; increased police protection; better measures to guard against air and water pollution; and expanded natural resource development programs and hospital facilities.

New or recently expanded Federal-State programs in education, vocational training, medicine, and other fields will increase greatly the requirements of local and State governments for professional, administrative, and technical personnel such as engineers, scientists, social workers, counselors, teachers, doctors, and librarians.

In addition to job opportunities resulting from the expected overall growth in State and local government employment, large numbers of employees will be needed to replace workers who transfer to other fields of work, retire, or die.

Most positions in State and local governments are filled by permanent residents of the State or locality. Often, however, it is necessary for State and local governments to recruit outside their areas if shortages of particular skills exist in their areas.

Earnings and Working Conditions

Earnings of State and local government employees vary widely, depending upon occupation and locality. Salaries from State to State tend to reflect differences in the general wage level in various localities. Clerical and blue-collar earnings in State and local governments generally are comparable to those of workers in similar occupations in private industry. Earnings of administrative and professional employees in many areas tend to be somewhat lower than those for workers in similar occupations in private industry.

The *Handbook* statements for individual occupations often give salary information for State and local government employment. Salary information also can be obtained from the appropriate agency in each State and locality.

A majority of State and local government positions are filled through some type of formal civil service test, and personnel are hired and promoted on the basis of merit. In some areas, broad groups of employees, such as teachers, firemen, and policemen, have separate civil service coverage which applies only to their specific groups.

Most State and local government employees are covered by retirement systems or by the Federal Social Security program. They usually work a 40-hour week; overtime pay or compensatory time benefits often are granted for hours of work in excess of the standard workweek.

Sources of Additional Information

People interested in working for State or local government agencies should contact the appropriate agencies in the State, county, or city. Local school boards, city clerks, school and college counselors or placement offices, and local offices of State employment services also will have further information.

ARMED FORCES

When planning their careers, young men must consider their military service obligation. By knowing the choices available for fulfillment of this obligation, they can better fit their service period into their occupational plans. In many instances, the service activities provide valuable vocational training which is helpful in obtaining civilian jobs later on. The Armed Forces also offer many opportunities to qualified young men and young women for lifetime service careers in many occupations.

The Armed Forces are maintained through voluntary enlistment, supplemented by a Selective Service System which drafts young men between 18½ and 26. A young man may enlist in any one of a variety of programs involving different combinations of active service and reserve duty; or he may wait to be drafted for a 2-year period of active duty, followed by 4 years in the reserves; or, if qualified, he may enter one of several officer training programs and discharge his obligation in a commissioned status.

Additional choices for fulfilling a military obligation are available in reserve programs. One of these choices allows a young man to fulfill his military obligation by enlisting in the reserves for 6 years, at least 4 months of which are spent in active duty training. These enlistment choices and the draft, however, are subject to change at any time by congressional action. The alternative choices described here in a general way serve only to illustrate a few possibilities. Detailed up-to-date information can be obtained from local Armed Forces recruiting stations or from publications available at high schools, colleges, and State employment service offices.

In 1970, military personnel were distributed among the various services as follows: Army, 1,231,000; Air Force, 755,000; Navy, 645,000; Marine Corps, 230,000; and Coast Guard, 38,000. A majority of all enlisted jobs in the Armed Forces require special in-service school training; on-the-job training is given for the remainder. It is possible for a young man, during his military service, to receive training in electronics, aircraft maintenance, metalworking, or other skilled work.

In addition to specific on-the-job training, the Armed Forces provide military personnel with a wide choice of voluntary off-duty academic and technical training programs. Military personnel may enroll in (1) the U.S. Armed Forces Institute (USAFI), (2) the Resident Center Program, (3) the Group Study Program, or (4) the Military Extension Correspondence Course Program. USAFI offers approximately 235 correspondence courses ranging from elementary school through the second year of college. In addition, approximately 6,000 courses are offered by colleges and universities under contract with USAFI. In the Resident Center Program, civilian institutions offer courses leading to high school diplomas and college degrees. These courses may be taken either on the military installation or on a nearby campus. The Group Study Program is offered on military installations where local civilian classes are not available. The Military Extension Correspondence Course Program provides technical courses in military specialties which are designed to advance career capabilities.

The Armed Forces also offer training to many servicemen during their final 6 months of service to prepare them for job opportunities in civilian life. The Transition Program provides counseling, training, education, and placement services to the combat-disabled, those having no civilian work experience, and those, including many combat veterans, who did not acquire civilian-related skills while in the service or had no opportunities to achieve high school graduation equivalency diplomas during their service.

Each of the services publishes handbooks describing entrance requirements, training, advancement, and other aspects of their career fields. These publications are available at all recruiting stations and at most State employment service offices, high schools, colleges, and public libraries.

TECHNICAL APPENDIX

This appendix is designed for readers who wish to know more about procedures followed in developing employment outlook than is presented in preceding reports.

Employment Outlook Conclusions

The employment outlook in the occupational reports is based on extensive economic and statistical analyses and information from many sources. Although sources and analyses among occupations and industries differed, the same general pattern was followed. To insure consistency of individual occupations and industries, the economy, based on an assumption of relatively full employment, was analyzed. Projections were made of the population, labor force, gross national product, average weekly hours, employment in major industries, and related economic measures and the individual reports were tied to these projections.

Many studies were based heavily on an analysis of past and prospective population trends, including expected changes in school and college enrollment, employment of women, and urban and suburban population. Population influences employment requirements in fields, such as teaching and health, and is of great importance in many industries—for example, residential construction, baking, telephone communication, and retail trade.

Many factors besides population size and composition affect employment in business and industry. Consumer purchasing patterns change as income levels shift and new products are developed. Technology brings changes in raw materials and equipment needed in production and influences the size, occupation, and skill of the work force. Research and development and government policies, such as defense and space programs, also bring about changes in occupations.

Each industry was analyzed and demands for its products or services were projected. These projections then were translated into estimates of numbers and kinds of workers needed to produce services and products. Taken into account were employment trends of total employment, different occupations, productivity trends, and possible further reductions in the workweek.

Population and labor force trends are from the decennial Censuses of Population and the monthly labor force surveys conducted by the Bureau of the Census for the Bureau of Labor Statistics. Data also were drawn from the Censuses of Manufactures and Business conducted by the Census Bureau.

Information also was utilized from a variety of sources. Among the major sources were licensing agencies, labor unions, professional and trade associations, and special surveys.

Statistics on employment in nonagricultural establishments provided monthly data on employment, hours of work, earnings, and labor turnover, based on reports for the past quarter-century or more* from a sample of industrial, commercial, and governmental establishments which employed approximately 31 million workers in March 1969.

Also contributing to the analysis of future trends was the Bureau's series of studies of productivity and technological development, information obtained in cooperation with the National Science Foundation about employment of scientists and engineers in research and other activities, and the Occupational Industry Matrix. The matrix consists of a set of tables for 116 industries, each showing a percentage distribution of employment among 160 of the most important occupations. The matrix was valuable in appraising the effects of changing employment levels in different industries, in specific occupations, and in each occupation.

Conclusions based on an analysis of these various sources generally show increased employment, but these expected gains do not indicate the number of job openings. In most occupations, more workers are needed yearly to replace those who retire, die, or leave the occupation than are needed for growth. Consequently, even declining occupations may offer employment opportunities to many young people. To estimate the number of possible openings in an occupation, the Bureau has developed tables, similar to the actuarial tables of life insurance companies, to assess future rates of replacement from deaths and retirement. In occupations in which men are predominant, the rate of replacement for death and retirement is generally between 1.5 and 2.5 percent compared with 3.5 and 4.5 percent for women because so many women leave paid employment for marriage or family responsibilities.

Information so far in this section relates to the demand for workers. To appraise prospective employment opportunities in an occupation, information on the probable future supply of personnel is important. Statistics on high school and college enrollments and graduations, compiled by the U.S. Office of Education, are the chief sources of information on the potential supply of personnel in the professions and other occupations requiring extensive formal education. Data on numbers of apprentices from the U.S. Department of Labor's Bureau of Apprenticeship and Training provides some information on new entrants into skilled trades.

Many of the sources and approaches referred to earlier have been developed in recent years. Economic forecasting is still in the developmental stage and at best is difficult and uncertain. Basic assumptions and underlying projections (enumerated on p. 13) should be kept in mind. Within the framework of assumptions, basic employment trends can be discerned with sufficient accuracy to meet the needs of young people preparing for careers.

---

*See *Employment and Earnings*, U.S. Department of Labor, Bureau of Labor Statistics.

Index to Occupations and Industries

Page
Able seamen, *see:* Unlicensed merchant seamen 748
Accelerator operators, atomic energy 636
Account clerks, *see:* Bank clerks 807
Account executives, advertising 32
Account executives, *see:* Securities salesmen 324
Accountants 29
  See also: Insurance business 813
Accounting-bookkeeping machine servicemen 479
Accounting clerks, *see:* Bookkeeping workers 285
Acidizers, petroleum and natural gas 597
Acquisition librarians 249
Actors and actresses 181
Actuaries 144
  See also: Insurance business 813
Adding machine operators 293
Adding machine servicemen 479
Adjusters, claim, insurance 816
Administrators, hospital 131
Adult services librarians 250
Advertising artists and layout men 33
Advertising copywriters 32
Advertising managers 32
Advertising production managers 32
Advertising workers 32
Aeronautical engineers, *see:* Aerospace engineers 67
Aeronautical technicians 221
Aeronomists, *see:* Geophysicists 152
Aerospace engineers 67
  See also: Aircraft, missile, and spacecraft manufacturing 607
Agents, *see:*
  Insurance agents and brokers 314
  Real estate salesmen and brokers 319
Agents, air traffic, civil aviation 728
Agricultural cooperative workers 591
Agricultural economists 589
Agricultural engineers 68
Agricultural management specialists 590
Agriculture 579
Agriculture, occupations related to 586
Agriculture teachers, vocational 590
Agronomists 11
  See also: Agriculture 589
Air-conditioning and refrigeration mechanics 463
  See also:
    Electronics manufacturing 656
    Office machine and computer manufacturing 696
Air-conditioning, heating, and refrigeration technicians 221
Air-conditioning, refrigeration, and heating mechanics 463
Air-route traffic controllers, civil aviation 725
Air traffic controllers, civil aviation 725
Air transportation occupations, *see:* Civil aviation 713
Aircraft, missile, and spacecraft manufacturing, occupations in 605
Aircraft mechanics, civil aviation 721
  See also: Aircraft, missile, and spacecraft manufacturing 610
Airframe mechanics, civil aviation 722
Airline dispatchers, civil aviation 724
Airline traffic agents and clerks, civil aviation 728
Airplane mechanics, aircraft mechanics 721
  See also: Aircraft, missile, and spacecraft manufacturing 610
Airplane pilots, civil aviation 713
Airport traffic controllers, civil aviation 725
Aluminum industry 614
Ampoule examiners, drug industry 648
Ampoule fillers, drug industry 648
Ampoule sealers, drug industry 648
Analysts, chemical, *see:*
  Aluminum industry 618
  Paper and allied products 703
Analysts, systems 257
Analysts, investment, *see:* Insurance business 813
Analytical chemists, *see:* Drug industry 646
Anatomists 163
Animal physiologists and animal husbandmen, *see:* Agriculture 589
Annealers, *see:*
  Aluminum industry 616
  Foundry industry 661
Announcers, radio and television 758
Anode men, aluminum industry 615
Anodizers, electronics manufacturing 655
Anthropologists 199
Apparel industry, occupations in the 621
Appliance servicemen 466
Appraisers, real estate 319
Arc cutters, *see:* Welders 572
Archeologists, *see:* Anthropologists 199

Page
Architects 237
Architects, landscape 244
Archivists, *see:* Historians 206
Armament assemblers, aircraft, missiles, and spacecraft 609
Armed Forcees 849
Art directors, *see:* Commercial artists 192
Artists, *see:*
  Advertising workers 33
  Commercial artists 192
Asbestos and insulating workers 377
Assemblers 529
  See also:
    Apparel industry 623
    Electronics manufacturing 654
    Laundry and dry cleaning plants 837
    Motor vehicle and equipment manufacturing 689
    Office machine and Computer manufacturing 696
Assemblers, bench 529
Assemblers, floor 529
Assembly inspectors, aircraft, missiles, and spacecraft 610
Assistant engineers, *see:* Licensed merchant marine officers 744
Associate-directors, radio and television 754
Astrogeologists 149
Astronomers 175
Astronautical engineers, *see:* Aerospace engineers 67
Astrophysicists, *see:* Astronomers 176
Atomic energy field, occupations in the 630
Attendants, gasoline service station 630
Attendants, hospital 354
Attendants, parking 556
Attorneys 246
Audio-control technicians, radio and television 760
Audiologists 120
Automatic pin setting machine mechanics 475
Automatic transmission specialists, *see:* Automobile mechanics 472
Automobile air-conditioning specialists, *see:* Automobile mechanics 473
Automobile body repairmen 469
Automobile-glass mechanics, *see:* Automobile mechanics 473
Automobile manufacturing occupations, *see:* Motor vehicle and equipment manufacturing 685
Automobile mechanics 471

Page
Automobile painters 530
Automobile parts countermen 308
Automobile-radiator mechanics, *see:* Automobile mechanics 473
Automobile salesmen 310
Automobile service advisors 312
Automobile trimmers and installation men 532
Automobile upholsterers 532
Auxiliary equipment operators, *see:* Electronic computer operating personnel 289
Auxiliary equipment operators, electric power 733
Auxiliary nursing workers, *see:* Hospital attendants 354
Aviation occupations, *see:* Civil aviation 713

Babysitters, *see:* Private household workers 356
Backtenders, paper and allied products 702
Bakers, all round 641
Baking industry 640
Baggers, laundry and dry cleaning 837
Bacteriologists, *see:* Drug industry 646
Ballet dancers 184
Bank clerks 806
Bank managers, branch 810
Bank officers 810
Bank tellers 808
Banking occupations 805
Bankmen, printing (graphic arts) 517
Bar boys, *see:* Bartenders 341
Barbers 332
Barker operators, paper and allied products 701
Bartenders 341
  See also: Restaurants 799
Bartender helpers 341
Beater engineers, paper and allied products 701
Beauticians 335
Beauty operators 335
Bell captains, hotel 829
Bellboys, hotel 829
Bellmen and bell captains, hotel 829
Bench assemblers 529
Bench hands, baking 641
Bench molders, foundry industry 666
Benchmen, optical mechanics 540
Bill clerks, *see:* Cashiers 286
Billing machine operators 292
Biochemists 166
  See also:
    Chemists 170
    Drug industry 646

Page
  Life scientists 163
Biological aides, *see:* Food processing technicians 228
Biological aides 220
Biological oceanographers, *see:*
  Life scientists 163
  Oceanographers 158
Biologists, *see:* Drug industry 646
Biomedical engineers 69
Biophysicists 163
Blacksmiths 535
Blockers, printing (graphic arts) 521
Blowers, iron and steel 676
Boardmen, general, *see:* Commercial artists 192
Boatswains, *see:* Unlicensed merchant seamen 748
Body repairmen, automobile 469
Boiler operators, electric power 733
Boilermakers 536
  See also:
    Iron and steel industry 681
    Railroad and shop trades 775
Boilermaking occupations 536
Bookbinders and related workers 527
Bookkeepers 285
  See also: Bank clerks 807
Bookkeeping and accounting clerks 285
  See also:
    Bank clerks 807
    Bookkeepers 285
Bookkeeping machine operators, *see:*
  Bank Clerks 807
  Office machine operators 292
Bookkeeping machine servicemen 479
Bookkeeping workers 285
Bookmobile librarians 250
Botanists 162
  See also: Drug industry 646
Bowling-pin-machine mechanics 475
Box office cashiers 286
Brake mechanics, *see:* Automobile mechanics 473
Brakemen, railroad 771
Branch bank managers 810
Bricklayers 379
  See also:
    Aluminum industry 618
    Iron and steel industry 680
Brickmasons 379
Bridge and building workers, railroad 779
Broadcast technicians, radio and television 759
Broadcasting occupations, radio and television 752

Page
Brokers, insurance 314
Brokers, real estate 319
Building custodians 358
Building laborers 388
Building trades 372
Bulldozer operators, *see:* Operating engineers 405
Bundlers, apparel 623
Bus boys and girls, restaurant 799
Bus mechanics 505
Busdrivers, intercity 436
Busdrivers, local transit 439
Bushelmen, apparel 625
Business administration and related professions 29
Business machine operators 292
Business machine servicemen 477
Butlers, *see:* Private household workers 357

Cabdrivers 442
Cable splicers, *see:*
  Electric power industry 737
  Telephone industry 787
Cable-tool drillers, petroleum and natural gas 596
Calculating machine operators 293
Calculating machine servicemen 479
Cameramen, printing (graphic arts), *see:*
  Lithographers 525
  Photoengravers 521
Captain, *see:* Licensed merchant marine officers 743
Captain, *see:* Pilots and copilots 715
Car parkers, parking attendants 556
Card-to-tape converter operators, *see:* Electronics computer operating personnel 289
Career counselors, college 239
Career planning counselors, college 239
Caretakers, *see:* Private household workers 357
Carmen, railroad shop 775
Carpenters 382
  See also: Foundries 661
Carpet layers, *see:* Floor covering installers 394
Cartographers, *see:* Geographers 204
Casework aides, *see:* Social service aides 360
Caseworkers, social 267
Cash accounting clerks, *see:* Cashiers 286
Cash register servicemen 479
Cashiers 286
Cashiers, *see:* Parking attendants 557
Cashiers, restaurant 800
Casting inspectors, foundry industry 661
Casting operators, *see:* Aluminum industry 616
Catalogers, *see:* Librarians 249

Page
Catholic priests 45
Cement finishers 385
Cement masons 385
Cementers, petroleum and natural gas 597
Central office craftsmen, telephone 784
Central office equipment installers, telephone 786
Central office operators, telephone 304
Central office repairmen, telephone 784
Central office supervisors, *see:* Telephone operators 304
Ceramic engineers 69
Certified public accountants 30
Chainmen, *see:* Surveyors 270
Chaplains, *see:* Clergymen 42
Check encoders, *see:* Bank clerks 807
Check inscribers, *see:* Bank clerks 807
Check-out clerks, *see:* Cashiers 286
Checkers, apparel industry 624
Checkers, *see:* Draftsmen 226
Checkers, motor vehicle and equipment manufacturing 690
Chefs, *see:* Cooks and chefs 336
Chemical analyst, *see:*
  Aluminum industry 618
  Paper and allied products 703
Chemical engineers 70
  See also:
    Aluminum industry 618
    Drug industry 647
    Industrial chemical industry 670
    Paper and allied products industry 703
    Petroleum refining 708
Chemical mixers, *see:* Photographic laboratory occupations 559
Chemical oceanographers 158
Chemical operators, industrial chemical 670
Chemical technicians 221
Chemists 169
  See also:
    Aluminum industry 618
    Atomic energy field 635
    Drug industry 646
    Electronics manufacturing 652
    Industrial chemical industry 670
    Iron and steel industry 681
    Paper and allied products 702
    Petroleum refining 708
Chief cooks, *see:* Unlicensed merchant seamen 749
Chief drillers, petroleum and natural gas 596

Page
Chief engineers, *see:* Licensed merchant marine officers 744
Chief engineers, radio and television 755
Chief mates, *see:* Licensed merchant marine officers 744
Chief mechanics, aircraft, missile, and spacecraft 610
Chief stewards, *see:* Unlicensed merchant seamen 749
Child psychologists 262
Child welfare workers, *see:* Social workers 267
Children's librarians 249
Chippers, foundry industry 661
Chippermen, paper and allied products 701
Chiropodists, *see:* Podiatrists 110
Chiropractors 111
Choreographers, *see:* Dancers 184
Christmas club bookkeepers, *see:* Bank clerks 806
Christmas club tellers, *see:* Bank tellers 809
Cindermen, iron and steel 676
City managers 277
City planners 272
Civil aviation occupations 713
Civil engineering technicians 222
Civil engineers 71
  See also: Iron and steel industry 681
Civil service workers, Federal Government 841
Civil service workers, State and local government 847
Civilian government, Federal 847
Claim adjusters, insurance 816
Claim examiners, insurance 819
  See also: Insurance business 813
Claim representatives, insurance 819
Claim reviewers, insurance 819
Claim workers, insurance 819
Claims clerks, *see:* Trucking industry 793
Cleaners, *see:* Building custodians 358
Clergymen 42
Clerical and related occupations 283
Clerk-typists 303
Clerks, *see:*
  Account clerks, bank clerks 807
  Accounting clerks, bookkeeping workers 285
  Airline traffic agents and clerks, civil aviation 728
  Bank clerks 806
  Bill clerks, cashiers 286
  Bookkeeping and accounting clerks 285
  Cash accounting clerks, cashiers 286

Page

    Check-out clerks, cashiers 286
Claim clerks, trucking industry 793
    Clerk-typists 303
    Commodity loan clerks, bank clerks 807
    Control clerks, bank clerks 807
    Counter clerks, laundry and drycleaning 835
    County collection clerks, bank clerks 807
    Disbursement clerks, cashiers 286
    Exchange clerks, *see:* Bank clerks 807
    Floor clerks and supervisors, hotel 831
    Interest clerks, bank clerks 807
    Law clerks, lawyers 247
    Mail clerks, post office 846
    Manifest clerks, trucking industry 793
    Mortgage clerks, bank clerks 807
    Mortgage clerks, typists 303
    Parts-order clerks, trucking industry 793
    Postal clerks 846
    Rack clerks, hotel 831
    Railroad clerks 774
    Rate clerks, trucking industry 793
    Receiving clerks, shipping and receiving clerks 296
    Reconcilement clerks, bank clerks 807
    Recording clerks, bank clerks 807
    Reservation agents and clerks, civil aviation 728
    Reservation clerks, hotel 831
    Room and desk clerks, hotel 830
    Sales clerks, retail trade 321
    Shipping and receiving clerks 296
    Stock clerks 298
    Stock clerks, motor vehicle and equipment manufacturing 690
    Traffic agents and clerks, civil aviation 728
    Transit clerks, bank clerks 807
    Trust investment clerks, bank clerks 807
    Waybill clerks, typists 303
Climatologists, *see:* Meteorologists 154
Clinical laboratory workers 122
Clinical psychologists 262
Clothing industry occupations, *see:* Apparel industry 621
Coil winders, electronics manufacturing 655
Coiler operators, aluminum industry 616
Collar pointers, apparel 625
College and university teachers 216
College career planning and placement counselors 239
College librarians 250

Page

College placement officers 239
Color technicians, *see:* Photographic laboratory occupations 558
Commercial account underwriters 822
Commercial artists 192
Commercial photographers 255
Commercial tellers, banking 809
Commodity loan clerks, *see:* Bank clerks 807
Companions, *see:* Private household workers 357
Composing room occupations, printing (graphic arts) 517
Composition roofers 416
Compositors, hand, printing (graphic arts) 517
Compounders, *see:* Drug industry 647
Compressors, *see:* Drug industry 647
Compressor-station engineers, petroleum and natural gas 597
Compressor-station operators, petroleum and natural gas 597
Computer geologists 149
Computer manufacturing 694
Computer operators, *see:* Electronic computer operating personnel 288
Computer programers, *see:* Paper and allied products industry 703
Computers prospecting, petroleum and natural gas 595
Computer salesmen, office machine and computer manufacturing 696
Concrete finishers 385
Conductors, railroad 770
Conservation occupations 48
Conservationists, range, *see:* Range managers 52
Conservationists, soil 588
Console operators, *see:* Electronic computer operating personnel 289
Construction 601
Construction electricians 390
Construction laborers and hod carriers 388
Construction machinery operators, *see:* Operating engineers 504
Consulting engineers, *see:* Architects 237
Continuity directors, radio and television 754
Continuity writers, radio and television 754
Control clerks, *see:* Bank clerks 807
Control room operators, electric power 734
Converter operators, *see:* Electronic computer operating personnel 289
Cooks/bakers, *see:* Unlicensed merchant seamen 749
Cooks, *see:* Private household workers 356

Page
Cooks and chefs . . . 336
Cooks' helpers, *see:* Private household workers 357
Cooperative extension service home economists 242
Cooperative extension service workers . . . 586
Copilots, civil aviation . . . 715
Copying machine servicemen . . . 480
Copywriters, advertising . . . 32
Core assemblers, foundry industry . . . 661
Coremakers, foundry . . . 667
Core-oven tenders, foundry industry . . . 661
Coremakers, *see:* Motor vehicle and equipment manufacturing . . . 689
Coresetters, foundry industry . . . 661
Corn and wheat farmers . . . 584
Correspondent bank officers, banking . . . 810
Corrugator operators, paper and allied products 702
Cosmetologists . . . 335
Cotton farmers . . . 584
Counseling . . . 55
Counseling psychologists, *see:* Psychologists . . 262
  See also: Rehabilitation counselors . . . 58
Counselers, *see:*
  Employment counselers . . . 55
  Rehabilitation counselers . . . 58
  School counselers . . . 60
Counter attendants, restaurant . . . 799
Counter clerks, laundry and drycleaning . . . 835
Counters, paper and allied products . . . 702
Country collection clerks, *see:* Bank clerks . . . 807
County extension workers, agricultural . . . 586
County home economics agents . . . 586
Court reporters . . . 300
Craftsmen, foreman, and kindred workers . . . 365
Crane operators, *see:*
  Foundry industry . . . 661
  Motor vehicle and equipment manufacturing . . . 690
  Operating engineers . . . 405
  Trucking industry . . . 793
Cranemen, *see:* Forge shop occupations . . . 446
Credit cashiers, *see:* Cashiers . . . 286
Crew chiefs, aircraft, missile, and spacecraft . . 610
Crop specialty farmers . . . 585
Crystal finishers, electronics manufacturing . . . 655
Crystal grinders, electronics manufacturing . . . 655
Cultural anthropologists . . . 199
Custodians, building . . . 358
Customer service occupations, electric power . 739
Customers' brokers, *see:* Securities salesmen . . 324
Cutters, apparel . . . 623

Page
Cutters, fur, apparel . . . 625
Cutters, meat . . . 552
Cutters, motor vehicle and equipment manufacturing . . . 689
Cutting room occupations, apparel . . . 622

Dairy farmers . . . 582
Dampproof workers, *see:* Roofer . . . 417
Dancers . . . 184
Dark-room technicians, *see:* Photographic laboratory occupations . . . 558
Data-processing equipment servicemen . . . 480
Data typists, *see:* Typists . . . 303
  See also: Electronic computer operators . 288
Deck-engine mechanics, *see:* Unlicensed merchant seamen . . . 749
Deck officers, *see:* Licensed merchant marine officers . . . 743
Deck utilitymen, *see:* Unlicensed merchant seamen . . . 748
Decontamination men, atomic energy . . . 636
Decorators, interior designers and . . . 196
Dehydration-plant operators, petroleum and natural gas . . . 597
Deliverymen, *see:* Routemen . . . 434
Dental assistants . . . 87
Dental hygienists . . . 85
Dental laboratory technicians . . . 89
Dentists . . . 82
Derrick operators, *see:* Operating engineers . . . 405
Derrickmen, petroleum and natural gas . . . 596
Derrickmen, *see:* Stonemasons . . . 421
Designers, apparel . . . 621
Designers, industrial . . . 194
Designers, interior . . . 196
Designers, scenic, television . . . 754
  See also: Interior designers and decorators 196
Designers, tool and machine, *see:* Mechanical technicians . . . 223
Designing room occupations, apparel . . . 621
Desk adjusters, claim examiners . . . 819
Detail men, *see:* Pharmacists . . . 107
Detailers, *see:* Draftsmen . . . 226
Detectives, police . . . 347
Developers, *see:* Photographic laboratory occupations . . . 558
Development engineers, radio and television . . 755
Developmental psychologists . . . 262
Dictating-machine servicemen . . . 480

Page

- Die makers, *see:*
  - Aluminum industry 618
  - Electronics manufacturing 655
  - Paper and allied products 702
- Die makers, tool-and 456
  - *See also* listing under Tool-and-die makers.
- Die sinkers, forge shop 447
- Diesel mechanics 483
- Dietitians 129
  - *See also:* Restaurant industry 800
- Digester operators, paper and allied products 701
- Directors, art, *see:* Commercial artists 192
- Directors, education, radio and television 754
- Directors, program, radio and television 754
- Directors, public affairs, radio and television 754
- Directory assistance operators 304
- Disbursement clerks, *see:* Cashiers 286
- Disc jockeys, radio and television 758
- Discount bookkeepers, *see:* Bank clerks 807
- Discount tellers, banking 809
- Dispatchers, *see:*
  - Civil aviation 724
  - Trucking industry 793
- Dispensing opticians and optical mechanics 539
  - *See also:* Optometrists 104
- District representatives, electric power 739
- Dividermen, baking industry 640
- Doctors, medical 77
- Domestic workers, *see:* Private household workers 356
- Dough molders, baking 640
- Draftsmen 226
  - *See also:*
    - Aluminum industry 618
    - Electronics manufacturing 653
    - Iron and steel industry 681
    - Motor vehicle and equipment manufacturing 687
    - Petroleum and natural gas production and processing 595
    - Petroleum refining 709
- Drama teachers, *see:* Actors and actresses 182
- Dressmakers, apparel 625
- Driver-salesmen, *see:*
  - Baking industry 642
  - Routemen 434
- Drivers, intercity buses 436
- Drivers, local transit buses 439
- Drivers, local trucks 431

Page

- Drivers, over-the-road trucks 427
- Drivers, taxi 442
- **Driving occupations** 427
- Drug industry, occupations in the 645
- Druggists 107
- Drycleaners, laundry and drycleaning 836
- Drycleaning plants 835
- Drycleaning routemen 434
- Duplicating and copying machine servicemen 480
- Duplicating machine operators 293
- Dynamic meteorologists 154

- Earth-boring machine operators, *see:* Operating engineers 405
- Ecologists, *see:* Life scientists 163
- Economic geographers 203
- Economic geologists 148
- Economists 201
- Economists, agricultural 589
- Editors, film, television 755
- Education directors, radio and television 754
- EEG technicians 99
- EKG technicians 100
- Electric power linemen 737
- **Electric power industry, occupations in the** 730
- Electric sign servicemen 486
- Electrical appliance servicemen 466
- Electrical assemblers, aircraft, missile, and spacecraft 610
- Electrical engineers 71
  - *See also:*
    - Aluminum industry 618
    - Electronics manufacturing 652
    - Industrial chemical industry 671
    - Iron and steel industry 681
    - Motor vehicle and equipment manufacturing 687
    - Paper and allied products industry 703
- Electrical repairmen, maintenance electricians 495
- Electrical repairmen, *see:* Iron and steel industry 681
- Electrical workers, *see:* Shop trades, railroads 775
- Electricians, construction 390
- Electricians, maintenance 495
  - *See also* listing under Maintenance electricians.
- Electrocardiographic technicians 100
- Electroencephalographic technicians 99
- Electronic assembly inspectors, *see:*
  - Electronics manufacturing 656

Page

- Office machine and computing manufacturing 697
- Electronic computer operating personnel 288
- Electronic computer programers 259
- Electronic reader-sorter operators, *see:* Bank clerks 807
- Electronic specialists, *see:* Oceanographers ... 158
- Electronics checkout men, aircraft, missile, and spacecraft 610
- Electronics engineers, *see:* Electronics manufacturing 652
- **Electronics manufacturing occupations** 651
- Electronics mechanics, aluminum 618
- Electronics repairmen, iron and steel 681
- Electronics subassembly inspectors, office machine and computer manufacturing 697
- Electronics technicians 222
  - *See also:*
    - Electronics manufacturing 653
    - Office machine and computer manufacturing 696
- Electroplaters 542
  - *See also:* Electronics manufacturing 655
- Electrotypers and stereotypers, printing (graphic arts) 522
- Elementary school teachers 211
- Elevator constructors 393
- Elevator mechanics 393
- Embossing machine operators 293
- Embryologists 163
- Employment aides, *see:* Social service aides ... 361
- Employment counselors 55
- Endodontic, *see:* Dentists 82
- Engine mechanics, aircraft, missile, and spacecraft 610
- Engineer aides, petroleum and natural gas ... 597
- **Engineering** 63
- Engineering aides, *see:* Electronics manufacturing 653
- Engineering and science technicians 220
- Engineering geologists 148
- Engineering psychologists, *see:* Psychologists .. 262
- Engineering technicians 618
- Engineers, *see:*
  - Aeronautical engineers 67
  - Aerospace engineers 67
  - Agricultural engineers 68
  - Astronautical engineers 67
  - Biomedical engineers 69
  - Ceramic engineers 69
  - Chemical engineers 70
  - Civil engineers 71
  - Electrical engineers 71
  - Electronics engineers 652
  - Industrial engineers 73
  - Mechanical engineers 73
  - Metallurgical engineers 74
  - Mining engineers 75
  - Oceanographic engineers 158
  - Petroleum engineers, petroleum and natural gas 595
- Engineers, compressor-station, petroleum and natural gas 597
- Engineers, development, radio and television . 755
- Engineers, flight, civil aviation 718
- Engineers, insurance 813
- Engineers, locomotive 767
- Engineers, operating, building trades 405
- Engineers, packaging, paper and allied products 703
- Engineers, petroleum 595
- Engineers, stationary 565
- Enginemen, petroleum and natural gas 596
- Entomologists 163
  - *See also:* Agriculture 590
- Envelope-machine operators, paper and allied products 702
- Environmental sciences 147
- Etchers, printing (graphic arts) 521
- Etching equipment operators, electronics manufacturing 655
- Ethnologists, *see:* Anthropologists 199
- Exchange clerks, *see:* Bank clerks 807
- Exhaust operators, electronics manufacturing . 655
- Experimental machinists, *see:* Instrument makers (mechanical) 458
- Experimental physicists 173
- Experimental psychologists 262
- Exploration geophysicists 151
- Extension service workers 586
- Extras, *see:* Actors and actresses 181
- Extrusion press operators, aluminum industry 617

- Fabrication inspectors, aircraft, missile, and spacecraft 610
- Family service workers, *see:* Social workers .. 267
- Farm equipment mechanics 489
- Farm housekeepers, *see:* Private household workers 356
- Farm managers 590

Page
Farm service jobs 592
Farmers, *see:* Agriculture 579
Fashion models 362
FBI Special Agents 345
Federal civilian government 841
Federal Government occupations 841
Field technicians, radio and television 760
File clerks 291
Film editors, television 755
Film librarians, television 755
Film numberers, *see:* Photographic laboratory technicians 558
Film strippers, *see:* Photographic laboratory technicians 559
Finance, insurance, and real estate 803
Finishers, flatwork, laundry and drycleaning 835
Finishers, men's suit, laundry and drycleaning 836
Finishers, shirt, laundry and drycleaning 835
Finishers, fur, apparel 625
Finishers, optical mechanics 540
Finishers, printing (graphic arts) 521
Firefighters 352
Firemen, *see:* Firefighters 352
Firemen (helpers), railroad 768
Firemen, stationary (boiler) 567
Firemen/watertenders, *see:* Unlicensed merchant seamen 748
Firers, hydrogen furnace, electronics manufacturing 655
Fitters, apparel 623
Fitup men, boilermaking occupations 537
Flagmen, railroad 771
Flame cutters, *see:* Welders 572
Flatwork finishers, laundry and drycleaning 835
Flight attendants, civil aviation 720
Flight engineers, civil aviation 718
Flight service station specialists, civil aviation 727
Flight superintendents, *see:* Airline dispatchers, civil aviation 724
Floor assemblers 529
Floor clerks and supervisors, hotel 831
Floor coremakers, foundry 667
Floor covering installers 394
Floor covering mechanics 394
Floor layers, *see:* Floor covering installers 394
Floor managers, radio and television 754
Floor molders, foundry industry 666
Floormen, television 754
Food checkers, restaurant 800
Food processing technicians 228

Page
Food scientists 178
Foreign exchange tellers, banking 809
Foremen 370
Foresters 48
  See also:
    Agriculture 580
    Paper and allied products 703
Forestry aids 50
Forestry technicians, *see:* Forestry aids 50
Forge shop occupations 445
Forklift truck operators, *see:*
  Electronics manufacturing 656
  Office machine and computer manufacturing 697
  Power truck operators 560
Foundry industry 660
Framemen, telephone central office craftsmen 784
Free-lance artists, *see:* Commercial artists 192
Free-lance photographers, *see:*
  Models 362
  Photographers 255
Front-end mechanics, *see:* Automobile mechanics 473
Front office clerks, hotel 830
Fur cutters, apparel 625
Fur finishers, apparel 625
Fur machine operators, apparel 625
Fur nailers, apparel 625
Fur shop occupations, apparel 625
Furnace installers (heating mechanics) 464
Furnace operators, foundry 661
Furniture upholsterers 544

Gagers, petroleum and natural gas 597
Garage mechanics, *see:* Automobile mechanics 471
Gas appliance servicemen 464
  See also: Air-conditioning, refrigeration, and heating mechanics 464
Gas burner mechanics 464
Gas fitters, *see:* Plumbers and pipefitters 413
Gas welders 572
Gas-compressor operators, petroleum and natural gas 597
Gasoline-plant engineers, petroleum and natural gas 597
Gasoline-plant operators, petroleum and natural gas 597
Gasoline service station attendants 546
Gasoline station salesmen 546
Gasoline station servicemen 546

Page
General boardmen, *see:* Commercial artists .. 192
General bookkeepers ... 285
General maids, *see:* Private household workers 356
General practitioners, *see:* Physicians ... 78
Geneticists ... 163
  See also: Agriculture ... 589
Geochemists, *see:* Geologists ... 148
Geochronologists, *see:* Geologists ... 149
Geodesists, *see:* Geophysicists ... 151
Geodetic surveyors ... 270
Geographers ... 203
Geological oceanographers ... 149
  See also: Oceanographers ... 158
Geologists ... 147
  See also: Petroleum and natural gas production and processing ... 594
Geomagneticians, *see:* Geophysicists ... 152
Geomorphologists, *see:* Geologists ... 149
Geophysicists ... 151
  See also: Petroleum and natural gas production and processing ... 595
Glass blowers, electronics manufacturing ... 655
Glass lathe operators, electronics manufacturing 655
Glaziers ... 397
Governesses, *see:* Private household workers . 357
Government occupations, Federal ... 841
  See also: Post office ... 846
Government occupations, State and local ... 847
Government, occupations in ... 839
Grain farmers, *see:* Corn and wheat farmers .. 584
Granulator-machine operators, *see:* Drug industry ... 647
Grid lathe operators, electronics manufacturing 655
Grinders, forge shop ... 447
Grocery checkers, *see:* Cashiers ... 286
Ground radio operators and teletypists, civil aviation ... 727
Ground water geologists ... 149
Groundmen, electric power ... 737
Guards and watchmen ... 343
Guidance counselors ... 60

Hairdressers ... 335
Hairstylists, *see:* Barbers ... 333
Hammermen, *see:*
  Forge shop ... 446
  Motor vehicle and equipment manufacturing ... 689
Hammersmiths, forge shop ... 446
Hand compositors, printing (graphic arts) ... 517

Page
Hand icers, baking ... 642
Hand molders, foundry industry ... 661
Hand sewers, apparel ... 624
Hand spreaders, apparel ... 623
Handymen, *see:* Private household workers ... 357
Health insurance agents ... 314
Health physicists, atomic energy ... 635
Health physics technicians, atomic energy ... 635
Health service occupations ... 77
Heat treaters, *see:*
  Aircraft, missile, and spacecraft manufacturing ... 609
  Forge shop ... 447
  Foundry industry ... 661
Heaters, *see:*
  Forge shop ... 446
  Iron and steel industry ... 668
Heating mechanics ... 464
Heavy equipment mechanics, *see:* Operating engineers ... 405
Helpers, baking ... 641
Helpers, iron and steel ... 674
High school teachers ... 214
High speed printer operators, *see:* Electronic computer operating personnel ... 289
Highway patrolmen, *see:* State police officers . 349
Highway surveyors ... 270
Historians ... 206
Hod carriers ... 388
  See also:
    Bricklayers ... 380
    Plasterers ... 411
Home economists ... 241
Home housekeepers, *see:* Private household workers ... 356
Horticulturists ... 163
Hospital administrators ... 131
Hospital attendants ... 354
Hospital nurses ... 92
Hospital recreation workers ... 264
Hot-cell technicians, atomic energy ... 636
Hot metal cranemen, *see:* Aluminum industry . 615
Hotel managers ... 833
Hotel occupations ... 827
Household workers, *see:* Private household workers ... 356
Housekeepers, *see:* Private household workers . 356
Housekeepers and assistants, hotel ... 832
Housemen, *see:* Private household workers ... 357
Human nutritionists, *see:* Agriculture ... 590

Page

Husbandry specialists (animal) 163
Hydrogen furnace firers, electronics manufacturing 655
Hydrologists, *see:* Geophysicists 152
Hygienists, dental 85

Icing mixers, baking 642
Illustrators, *see:* Commercial artists 192
Independent adjusters 817
Industrial chemical industry, occupations in the 669
Industrial designers 194
  See also: Electronics manufacturing 652
Industrial engineers 73
  See also:
    Aluminum industry 618
    Apparel industry 625
    Drug industry 647
    Electronics manufacturing 652
    Motor vehicle and equipment manufacturing 687
Industrial machinery repairmen 491
Industrial meteorologists 154
Industrial nurses 92
Industrial photographers 255
Industrial psychologists 262
Industrial recreation workers 264
Industrial salesmen 317
Industrial technicians 222
Industrial traffic managers 279
Infants' nurses, *see:* Private household workers 356
Informal models 362
Infrared oven operators, electronics manufacturing 655
Ingot strippers, iron and steel 677
Inhalation therapists 102
Inside adjusters, claim examiners 819
Inspectors, laundry and drycleaning 836
Inspectors (manufacturing) 548
  See also:
    Aircraft, missile, and spacecraft manufacturing 610
    Apparel industry 624
    Electronics manufacturing 655
    Forge shop 446
    Motor vehicle and equipment manufacturing 689
    Paper and allied products industry 703
Installation men, *see:* Automobile trimmers (automobile upholsterers) 533

Page

Installers and repairmen, telephone and PBX 790
Installers, floor covering 394
Installers, telephone central office equipment 786
Instrument makers (mechanical) 458
Instrument men, *see:* Instrument repairmen 492
Instrument repairmen 492
  See also:
    Drug industry 648
    Industrial chemical industry 670
    Paper and allied products industry 702
    Petroleum and natural gas production and processing 597
Instrument technicians, *see:* Mechanical technicians 223
Instrumentmen, *see:* Surveyors 270
Insulating workers 377
Insurance agents and brokers 314
Insurance business, occupations in the 812
Insurance salesmen, underwriters 821
Intercity busdrivers 436
Intercity truckdrivers 427
Interest-accrual bookkeepers, *see:* Bank clerks 807
Interest clerks, *see:* Bank clerks 807
Interior designers and decorators 196
International officers, banking 810
Intertype machine operators, printing (graphic arts) 518
Interviewers, marketing research 35
Investigators, FBI 345
Investment analysts, *see:* Insurance business 813
Iron and steel industry, occupations in the 674
Iron workers, building trades 423

Janitors, *see:*
    Building custodians 358
    Restaurant industry 799
Jewelers and jewelry repairmen 549
Jig and fixture builders, aircraft, missile, and spacecraft 608

Keepers, iron and steel 676
Keypunch operators 288
Kindergarten teachers 211
Kitchen workers, restaurant 799

Laboratory assurance technicians, *see:* Food processing technicians 228
Laboratory analysts, *see:* Food processing technicians 228

Page
Laboratory technicians 220
See also:
Aluminum industry 618
Drug industry 647
Electronics manufacturing 653
Industrial chemical industry 671
Iron and steel industry 681
Petroleum refining 708
Paper and allied products industry 703
Laboratory technicians, dental 89
Laboratory technicians, optical 539
Laborers and hod carriers, building trades 388
Ladle cranemen, iron and steel 677
Land surveyors 270
Landmen, petroleum and natural gas 595
Landscape architects 244
Larrymen, iron and steel 676
Lathers 399
Laundresses, *see:* Private household workers 356
Law clerks, *see:* Lawyers 247
Laundry and drycleaning plants 835
Lawyers 246
See also: Insurance 813
Layout artists, *see:* Commercial artists 192
Layout men, advertising 33
See also: Commercial artists 192
Layout men, Boilermaking occupations 537
Leasemen, petroleum and natural gas 595
Lens grinders, *see:* Optical mechanics 540
Letterers, *see:* Commercial artists 192
Librarians 248
Librarians, medical record 127
Librarians, tape, *see:* Electronic computer operating personnel 289
Librarians, television film 755
Library technicians 253
Licensed merchant marine officers 743
Licensed practical nurses 94
Licensed vocational nurses 94
Life insurance agents 314
Life sciences 161
Life scientists 161
Lighting technicians, television 760
Line-haul truckdrivers 427
Line maintenance mechanics, civil aviation 722
Linemen, *see:*
Electric power industry 737
Telephone industry 787
Linemen and cable splicers, telephone 787
Linotype operators, printing (graphic arts) 518

Page
Lithographic artists, printing (graphic arts) 525
Lithographic occupations, printing (graphic arts) 525
Livestock farmers 583
Load dispatchers, electric power 736
Loan officers, banking 810
Local government occupations 847
Local transit busdrivers 439
Local truckdrivers, *see:*
Driving occupations 431
Trucking industry 793
Locomotive engineers, railroad 767
See also: Iron and steel industry 681
Locomotive firemen (helpers), railroad 768
Long distance operators, telephone 304
Long-haul truckdrivers 427
Lubrication men, *see:* Trucking industry 793

Machine coremakers, foundry 667
Machine designers, *see:* Mechanical technicians 222
Machine icers, baking 642
Machine molders, *see:*
Foundry industry 665
Motor vehicle and equipment manufacturing 689
Machine movers, *see:* Riggers and movers 424
Machine spreaders, apparel 623
Machine tool operators 454
See also:
Aircraft, missile, and spacecraft manufacturing 608
Electronics manufacturing 655
Foundry industry 661
Iron and steel industry 680
Motor vehicle and equipment manufacturing 688
Office machine and computer manufacturing 696
Machined parts inspectors, *see:*
Aircraft, missile, and spacecraft 610
Office machine and computer manufacturing 696
Machinery repairmen, industrial 491
Machining occupations 449
See also: Motor vehicle and equipment manufacturing 688
Machinists, all-round 452
See also:
Aircraft, missile, and spacecraft manufacturing 608

Page
    Baking industry 643
    Drug industry 648
    Electronics manufacturing 655
    Foundry industry 661
    Instrument makers (mechanical) 458
    Iron and steel industry 680
    Office machine and computer manufacturing 696
    Railroad shop trades 775
Maids, *see:* Private household workers 356
Mail clerks, post office 846
Mail preparing and mail handling machine operators, office machine operators 293
Mailing equipment servicemen 481
Mailmen, post office 846
Maintenance electricians 495
  See also:
    Aluminum industry 618
    Baking industry 643
    Drug industry 648
    Electronics manufacturing 656
    Industrial chemicals industry 670
    Iron and steel industry 681
    Paper and allied products industry 702
    Petroleum and natural gas production and processing 597
    Railroad shop trades 775
Maintenance machinists, *see:*
    Aluminum industry 618
    Electronics manufacturing 656
    Industrial chemicals industry 670
    Office machine and computer manufacturing 697
    Paper and allied products industry 702
Maintenance mechanics, *see:* Industrial machinery repairmen 491
Maintenance technicians, radio and television 760
Maintenance welders, *see:* Electronics manufacturing 656
Makeup artists, television 754
Makeup men, printing (graphic arts) 517
Managerial occupations 275
Managers, branch bank 810
Managers, city 277
Managers, industrial traffic 279
Managers, range 52
Managers, restaurant 799
Managers, sales, *see:* Radio and television broadcasting 756
Managers and assistants, hotel 823

Page
Manifest clerks, *see:* Trucking industry 793
Manipulator operators, iron and steel 679
Manufacturers' salesmen 317
Manufacturing 603
Marble setters, tile setters, and terrazzo workers 401
Marine biologists, *see:* Oceanographers 158
Marine geologists, *see:* Oceanographers 158
Marine meteorologists, *see:* Oceanographers 158
Markers, apparel 623
Markers, laundry and drycleaning 835
Marketing research workers 34
Masons, brick 379
Masons, cement and concrete 385
Masons, stone 421
Master, *see:* Licensed merchant marine officers 743
Material handlers, apparel 624
Materials handlers, *see:*
    Motor vehicle and equipment manufacturing 690
    Trucking industry 793
Mates, *see:* Licensed merchant marine officers 743
Mathematical assistants, electronics manufacturing 653
Mathematical statisticians 139
  See also: Statisticians 142
Mathematicians 139
  See also:
    Electronics manufacturing 652
    Office machine and computer manufacturing 695
    Statisticians 142
Mathematics and related fields 139
Meat cutters 552
Mechanical engineers 73
  See also:
    Aluminum industry 618
    Electronics manufacturing 652
    Industrial chemical industry 671
    Iron and steel industry 681
    Motor vehicle and equipment manufacturing 687
    Office machine and computer manufacturing 695
    Paper and allied products industry 703
Mechanical technicians 222
Mechanic-attendants, *see:* Gasoline service station attendants 546
Mechanics, *see:*
    Air-conditioning mechanics 463

Page
Aircraft, missile, and spacecraft manufacturing ... 610
Aircraft mechanics ... 721
Automobile mechanics ... 471
Bowling-pin-machine mechanics ... 475
Bus mechanics ... 505
Diesel mechanics ... 483
Dispensing opticians and optical mechanics 539
Farm equipment mechanics ... 489
Gas burner mechanics ... 464
Heating mechanics ... 464
Motorcycle mechanics ... 499
Oil burner mechanics ... 464
Refrigeration mechanics ... 463
Truck mechanics ... 505
Vending machine mechanics ... 507
See also listing under Servicemen and Repairmen.
Mechanics and repairmen ... 462
Media directors, advertising ... 32
Medical assistants ... 95
Medical laboratory assistants ... 122
Medical laboratory technicians ... 122
Medical laboratory workers ... 122
Medical record librarians ... 127
Medical sales representatives, *see:* Pharmacists 107
Medical social workers ... 267
Medical technologists ... 122
Medical X-ray technicians ... 126
Melters, *see:*
Foundry industry ... 661
Iron and steel industry ... 677
Motor vehicle and equipment manufacturing ... 689
Men's suit finishers, laundry and drycleaning .. 836
Mental health occupations, *see:*
Nurses ... 94
Physicians (psychiatrists) ... 77
Psychiatric aides (hospital attendants) ... 354
Psychologists ... 261
Social workers ... 266
Merchant marine occupations ... 741
Merchant marine officers, licensed ... 743
Messmen, *see:* Unlicensed merchant seamen . 749
Metal finishers, motor vehicle and equipment manufacturing ... 689
Metal patternmakers, foundry industry ... 663
Metal roofers ... 416

Page
Metallurgical engineers ... 74
See also:
Drug industry ... 647
Iron and steel industry ... 681
Metallurgists, *see:*
Aluminum industry ... 618
Electronics manufacturing ... 653
Iron and steel industry ... 681
Motor vehicle and equipment manufacturing ... 687
Meteorological instrumentation specialists ... 154
Meteorologists ... 154
Meter installers, electric power ... 739
Meter readers, electric power ... 739
Meter repairmen, electric power ... 739
Meter testers, electric power ... 739
Metermen, electric power ... 739
Microbiologists, *See:*
Agriculture ... 590
Drug industry ... 646
Life sciences ... 162
Millwrights ... 498
See also:
Aluminum industry ... 618
Foundry industry ... 661
Iron and steel industry ... 681
Motor vehicle and equipment manufacturing ... 690
Paper and allied products industry .. 702
Mineralogists, *see:*
Geologists ... 148
Petroleum and natural gas ... 595
Mining ... 593
Mining engineers ... 75
Ministers, Protestant ... 42
Missile assembly mechanics, aircraft, missile, and spacecraft ... 609
Missile manufacturing occupations ... 605
Missionaries, *see:* Clergymen ... 42
Mixers, baking ... 640
Models ... 362
Modelmakers, *see:*
Instrument makers (mechanical) ... 458
Motor vehicle and equipment manufacturing ... 686
Molders' helpers, foundry industry ... 661
Molders, *see:* Foundry industry ... 665
Molding machine operators, baking industry .. 640

Page
Monitors, radiation, atomic energy 635
Monotype caster operators, printing (graphic arts) 518
Monotype keyboard operators, printing (graphic arts) 518
Mortgage clerks, *see:*
  Bank clerks 807
  Typists 303
Mothers' helpers, *see:* Private household workers 356
Motion picture projectionists 554
Motorcycle mechanics 499
Motor vehicle and equipment manufacturing occupations 685
Motor vehicle body repairmen 469
Music directors, radio and television 754
Music librarians, radio and television 754
Musicians and music teachers 186

Nailers, fur, apparel 625
Natural gas production and processing 593
Natural sciences 147
Neighborhood workers, *see:* Social service aides 361
Neon sign servicemen 486
News directors, radio and television 754
Newscasters, radio and television 754
Newspaper reporters 231
Newswriters, radio and television 754
Note tellers, banking 809
Nuclear reactor operators, atomic energy 636
Nurse aides, *see:* Hospital attendants 354
Nurse educators, *see:* Registered nurses 92
Nurse maids, *see:* Private household workers 356
Nurses, industrial 92
Nurses, licensed practical 94
Nurses, licensed vocational 94
Nurses, registered 91
Nursing assistants, *see:* Hospital attendants 354
Nutritionists 163
  See also: Dietitians 129

Observers, petroleum and natural gas 595
Occupational health nurses 92
Occupational therapists 113
Occupational therapists assistants 115
Oceanographers 157
Oceanographic engineers, *see:* Oceanographers 158
Odd-job men, *see:* Private household workers 357
Office machine and computer manufacturing 694
Office machine operators 292

Page
Office machine servicemen 477
Office nurses 92
Oil burner mechanics 464
Oilers, *see:* Unlicensed merchant seamen 748
Operating engineers, construction machinery 405
Operating room technicians 97
Operations agents, civil aviation 728
Operations officers, banking 810
Operatives, *see:* Semiskilled workers, industrial 367
Operators, resistance welding 572
Operators, telephone 303
Ophtholmologists, *see:* Optometrists 104
Optical laboratory technicians 539
Optical mechanics 539
Opticians, dispensing 539
Optometric assistants 106
Optometrists 104
Oral pathology, *see:* Dentists 82
Oral surgeons, *see:* Dentists 82
Orderlies, *see:* Hospital attendants 354
Ordinary seamen, *see:* Unlicensed merchant seamen 748
Organic chemists, *see:* Drug industry 646
Ornamental-iron workers, building trades 424
Orthodonists, *see:* Dentists 82
Osteopathic physicians 80
Outreach workers, *see:* Social service aides 361
Outside production inspectors, aircraft, missile, and spacecraft 610
Ovenmen, baking 641
Over-the-road truckdrivers, *see:*
  Driving occupations 427
  Trucking occupations 792
Oxygen cutters 572

Packaging engineers, paper and allied products 703
Painters, automobile 530
Painters, production 562
  See also listing under Production painters.
Painters and paperhangers 407
Paleonclimatologists, *see:* Meteorologists 154
Paleomagneticians, *see:* Geophysicists 152
Paleontologists, *see:*
  Geologists 149
  Petroleum and natural gas 595
Pantrymen and pantrywomen, restaurants 799
Paper and allied products industries 700
Paper inspectors, paper and allied products 703
Paper machine operators, paper and allied products 701

Page

Paper sorters and counters, paper and allied products 702
Paper testers, paper and allied products 703
Paperhangers 407
Parking attendants 556
Parole officers, *see:* Social workers 268
Parts changers, electronics manufacturing 656
Parts countermen, automobile 308
Parts-order clerks, *see:* Trucking industry 793
Paste-up men, *see:*
  Commercial artists 192
  Printing (graphic arts) occupations 519
Pastors, *see:* Clergymen 42
Pathologists 163
  See also:
    Drug industry 646
    Medical laboratory workers 122
Pathologists, speech 120
Patrolmen, *see:*
  Police officers 347
  State police officers 349
Pattern graders, apparel 622
Patternmakers, apparel 622
Patternmakers, *see:*
  Foundry industry 663
  Motor vehicle and equipment manufacturing 689
Paying and receiving tellers, banking 809
Payroll tellers, banking 809
PBX installers and repairmen, telephone 790
PBX operators, *see:* Telephone operators 304
Peanut farmers 584
Pedodontics, *see:* Dentists 82
Perforator operators, petroleum and natural gas 597
Performing artists and other related occupations 181
Periodontology, *see:* Dentists 82
Personal maids, *see:* Private household workers 356
Personnel workers 37
Petroleum and natural gas production and processing 593
Petroleum engineers, *see:* Petroleum and natural gas production and processing 595
Petroleum geologists 148
  See also: Petroleum and natural gas production and processing 594
Petroleum refining 707
Petrologists, geologists 148
  See also: Petroleum and natural gas production and processing 595

Page

Pharmacists 107
  See also: Drug industry 646
Pharmacist mates, *see:* Licensed merchant marine officers 745
Pharmaceutical chemists, *see:* Drug industry 646
Pharmaceutical operators, *see:* Drug industry 647
Pharmacologists, *see:*
  Drug industry 646
  Life scientists 164
Photocheckers and assemblers, *see:* Photographic laboratory occupations 559
Photo-journalists, *see:* Photographers 255
Photoengravers, printing (graphic arts) 521
Photogeologists, *see:* Petroleum and natural gas production and processing 595
Photogrammetric surveyors 270
Photograph retouchers, *see:* Photographic laboratory occupations 558
Photographers 254
Photographic laboratory occupations 558
Photographic models, *see:* Models 362
Phototypesetting machine operators, printing (graphic arts) 519
Physical anthropologists 200
Physical chemists 646
Physical geographers 204
Physical metallurgists, *see:* Aluminum industry 618
Physical meteorologists 154
Physical oceanographers 158
Physical scientists 169
Physical-science aides, *see:* Food processing technicians 228
Physical therapists 116
Physical therapy assistants 118
Physicians 77
Physicists 173
  See also:
    Atomic energy field 634
    Electronics manufacturing 652
    Office machine and computer manufacturing 695
Physicists, health, atomic energy 635
Physicists, radiological, atomic energy 635
Physiologists, *see:*
  Drug industry 646
  Life scientists 164
Picklers, forge shop 447
Piercer machine operators, iron and steel 680
Pill and tablet coaters, drug industry 648
Pilots and copilots, civil aviation 715

Page
Pinsetting machine mechanics, *see:* Bowling-pin-machine mechanics 475
Pipefitters 413
  See also:
    Drug industry 648
    Industrial chemical industry 670
    Iron and steel industry 681
    Motor vehicle and equipment manufacturing 690
    Paper and allied products industry 702
Placement counselers, *see:* College placement officers 239
Plainclothesmen, *see:* Police officers 347
Planetologists, *see:* Geophysicists 152
Planning counselors, college 239
Planners, urban 272
Plant facilities technicians, *see:* Food processing technicians 228
Plant quarantine and plant pest control inspectors, *see:* Agriculture 590
Plant scientists, *see:* Agriculture 590
Plasterers 410
Platemakers, printing (graphic arts) 526
Platers, electroplaters 542
  See also:
    Aircraft, missile, and spacecraft manufacturing 609
    Motor vehicle and equipment manufacturing 689
Plumbers and pipefitters 413
  See also:
    Aluminum industry 618
    Motor vehicle and equipment manufacturing 690
Podiatrists 110
Police officers 346
Policemen, *see:*
    Police officers 347
    State police officers 349
Policewomen 347
Policy writers, *see:* Typists 303
Polishers, motor vehicle and equipment manufacturing 689
Political geographers 203
Political scientists 207
Portable equipment operators, *see:* Track workers, railroad 778
Porters, restaurant 799
Portrait photographers 255
Post office occupations 846

Page
Postage and mailing equipment servicemen 481
Postal clerks 846
Posting machine operators, *see:* Bank clerks 807
Pot liners, *see:* Aluminum industry 615
Potmen, *see:* Aluminum industry 615
Poultry farmers 583
Pourers, *see:*
    Foundry industry 661
    Iron and steel industry 677
Power brake operators, aircraft, missile, and spacecraft 608
Power dispatchers, electric power 736
Power hammer operators, aircraft, missile, and spacecraft 608
Power linemen, electric power 737
Powerplant installers, aircraft, missile, and spacecraft 610
Powerplant operators, *see:* Drug industry 648
Power truck operators 560
  See also:
    Motor vehicle and equipment manufacturing 690
    Trucking industry 793
Powerplant mechanics, civil aviation 722
Powerplant occupations, electric power 733
Power shear operators, aircraft, missile, and spacecraft 608
Practical nurses 94
Press feeders, printing (graphic arts) 524
Press operators, forge shop 446
Press photographers 255
Pressers, apparel 625
Pressing occupations, apparel 625
Pressmen, printing (graphic arts) 523
Priests, Roman Catholic 45
Print developers, machine, *see:* Photographic laboratory occupations 559
Printer operators, *see:* Photographic laboratory occupations 559
Printer-slotter operators, paper and allied products 702
Printers, *see:* Photographic laboratory occupations 558
Printers, printing (graphic arts) 521
Printing (graphic arts) occupations 513
Printing pressmen and assistants, printing (graphic arts) 523
Private duty nurses 92
Private household workers 356
Private outdoor recreation farmers 585

Page
Probation and parole officers, *see:* Social workers ... 268
Process metallurgists, *see:* Aluminum industry . 618
Producers, program radio and television 754
Producer-directors, program, radio and television ... 754
Production managers, advertising ... 32
Production painters ... 562
  See also:
    Aircraft, missile, and spacecraft manufacturing ... 609
    Motor vehicle and equipment manufacturing ... 689
Production planners, aircraft, missile, and spacecraft ... 607
Production technicians, *see:* Industrial engineering technicians ... 222
Professional and related occupations ... 25
Profile cutting machine operators, aircraft, missile, and spacecraft ... 608
Program assistants, radio and television ... 754
Program directors, radio and television ... 754
Program, producer-directors, radio and television ... 754
Programers, electronic computer ... 259
  See also:
    Insurance ... 813
    Office machine and computer manufacturing ... 695
    Paper and allied products ... 703
Projectionists, *see:* Motion pictures ... 554
Proof machine operators, *see:* Bank clerks ... 806
Proofers, printing (graphic arts) ... 521
Proofreaders, printing (graphic arts) ... 517
Property and liability insurance agents and brokers ... 314
Prosthodontics, *see:* Dentists ... 82
Protestant ministers ... 42
Psychiatric aides, *see:* Hospital attendants ... 354
Psychiatric social workers ... 267
Psychologists ... 261
Public affairs directors, *see:* Radio and television 754
Public adjusters, claim adjusters ... 817
Public health nurses ... 92
Public health nutritionists, *see:* Dietitians 130
Public health sanitarians, *see:* Sanitarians 134
Public librarians ... 249
Public relations workers ... 39
Public stenographers ... 300
Pulp testers, paper and allied products ... 703

Page
Pumpers, petroleum and natural gas ... 597
Pumpmen, petroleum refining ... 708
Punch press operators, *see:*
    Aircraft, missile, and spacecraft manufacturing ... 608
    Motor vehicle and equipment manufacturing ... 689
Purchasing agents ... 281
Pursers, *see:* Licensed merchant marine officers 745

Quality assurance technicians, *see:* Food processing technicians ... 228

Rabbis ... 44
Rack clerks, hotel ... 831
Radiation monitors, atomic energy ... 635
Radio and television announcers ... 758
Radio and television broadcasting occupations 752
Radio officers, *see:* Licensed merchant marine officers ... 745
Radio operators, ground, civil aviation ... 727
Radio service technicians ... 502
Radiochemists, *see:* Drug industry ... 646
Radiographers, *see:*
    Aluminum industry ... 617
    Atomic energy ... 636
Radioisotope-production operators, atomic energy ... 636
Radiologic technologists ... 126
Radiological physicists, atomic energy ... 635
Railroad bridge and building workers ... 779
Railroad clerks ... 774
Railroad conductors ... 770
Railroad occupations ... 763
Ranchers ... 583
Range conservationists, *see:* Range managers . 52
Range managers ... 52
Range scientists, *see:* Range managers ... 52
Rate clerks, *see:* Trucking industry ... 793
Real estate salesmen and brokers ... 319
Realtors ... 319
Receiving clerks, *see:* Shipping and receiving clerks ... 296
Receiving inspectors, aircraft, missile, and spacecraft ... 610
Receiving tellers, banking ... 809
Receptionists ... 295
Reconcilement clerks, *see:* Bank clerks ... 807
Recording clerks, *see:* Bank clerks ... 807

Page
Recording technicians, radio and television .. 760
Recreation workers 264
Reference librarians 249
Refinery mechanics, petroleum refining 708
Refrigeration engineers, *see:* Unlicensed merchant seamen 749
Refrigeration mechanics 463
Regional geographers 204
Regional planners 272
Registered nurses 91
Registered representatives, *see:* Securities salesmen 324
Rehabilitation counselors 58
Rehabilitation workers, *see:* Social workers .. 268
Reinforcing-iron workers, building trades 424
Remelt operators, *see:* Aluminum industry ... 615
Renderers, *see:* Commercial artists 192
Repairmen, *see:*
  Aircraft mechanics 723
  Automobile body repairmen 469
  Central office repairmen, telephone 786
  Industrial machinery repairmen 491
  Instrument repairmen 492
  Jewelry repairmen 549
  Shoe repairmen 563
  Telephone and PBX repairmen 789
  Television and radio service technicians . 502
  Vending machine operators 507
  Watch repairmen 510
    See also listings under Mechanics and under Servicemen.
Reporters, newspaper 231
Reporting stenographers 300
Research and development technicians, *see:* Food processing technicians 228
Research directors, advertising 32
Research workers, marketing 34
Reservation agents and clerks, civil aviation . 728
Reservation clerks, hotel 831
Reservation control agents 728
Resilient floor layers, *see:* Floor covering installers 394
Resistance-welding operators 572
Restaurant industry 799
Retail trade salesworkers 321
Reviewers, claim 819
Rewrite men, *see:* Newspaper reporters 231
Rig builders, petroleum and natural gas 595
Riggers and machine movers, building trades . 424
Riveters, aircraft, missile, and spacecraft 609

Page
Rocket assembly mechanics, aircraft, missile, and spacecraft 609
Rodmen, *see:* Reinforcing-iron workers 424
Rodmen, *see:* Surveyors 270
Roll turners, iron and steel 681
Rollers, iron and steel 679
Rolling mill operators, *see:* Aluminum industry 616
Roman Catholic Priests 45
Roofers 416
Room and desk clerks, hotel 830
Rotary drillers, petroleum and natural gas .. 596
Roustabouts, petroleum and natural gas 596
Route salesmen, *see:* Routemen 434
Route salesmen and drivers, laundry and drycleaning 835
Route supervisors, baking 642
Routemen 434
  See also: Baking industry 642
Routers, printing (graphic arts) 521
Rural sociologists, agriculture 590

Sales clerks, retail trade 321
Sales engineers, *see:* Manufacturers' salesmen . 317
Sales managers, *see:*
  Hotels 833
  Radio and television broadcasting 756
Sales occupations 307
Salesworkers, *see:*
  Automobile parts countermen 308
  Automobile salesmen 310
  Automobile service advisors 312
  Insurance agents and brokers 319
  Manufacturers' salesmen 317
  Radio and television salesmen 755
  Real estate salesmen and brokers 319
  Retail trade salesworkers 321
  Securities salesmen 324
  Wholesale trade salesworkers 327
Sample stitchers, apparel 622
Sample-taker operators, petroleum and natural gas 597
Sand mixers, foundry industry 661
Sandblasters, forge shop 447
Sanitarians 133
Savings tellers, banking 809
Scalemen, *see:* Aluminum industry 615
Scalper operators, *see:* Aluminum industry .. 616
Scenic designers, television 754
  See also: Interior designers and decorators 196
School counselors 60

Page
School media specialists, *see:* Librarians 250
School psychologists 262
School recreation workers 264
School social workers 267
School teachers, *see:* Agriculture 590
School teachers, *see:* Teachers 211
Science aids 220
Science information specialists, *see:* Librarians 250
Science technicians 220
Scientists, environmental 147
Scientists, life 161
Scientists, natural 147
Scientists, physical 169
Scientists, range 52
Scientists, soil 587
Sealers, electronics manufacturing 655
Seamstresses, laundry and drycleaning 837
Seat-cover installers, *see:* Automobile trimmers and installation men 533
Second assistant engineers, *see:* Licensed merchant marine officers 744
Second electricians, *see:* Unlicensed merchant seamen 749
Second mates, *see:* Licensed merchant marine officers 744
Secondary school teachers 214
  See also: Home economists 241
Secretaries 300
Securities salesmen 324
Securities tellers, banking 809
Sedimentologists, *see:* Geologists 149
Seismologists, *see:* Geophysics 151
Semiskilled workers, industrial 367
Service advisors, *see:* Automobile service advisors 312
Service and miscellaneous 825
Service occupations 331
Service salesmen, *see:* Automobile service advisors 312
Service station attendants, *see:* Gasoline service station attendants 546
Service station mechanic-attendants 546
Service writers, *see:* Automobile service advisors 312
Servicemen, *see:*
  Appliance servicemen 466
  Business machine servicemen 477
  Electric sign servicemen 486
  Gas appliance servicemen 464
  Neon sign servicemen 486
  Telephone and PBX servicemen 789
  Television and radio service technicians 502
Setup men (machine tools) 460
Sewage plant operators 569
Sewers, hand, apparel 624
Sewing machine operators, *see:*
  Apparel industry 624
  Motor vehicle and equipment manufacturing 689
Sewing room occupations, apparel 623
Shakeout men, *see:*
  Foundry industry 661
  Motor vehicle and equipment manufacturing 689
Shearmen, iron and steel 679
Sheet-metal workers 419
  See also:
    Aircraft, missile, and spacecraft manufacturing 608
    Railroad shop trades 775
Shipping and receiving clerks 296
Ship's carpenters, *see:* Unlicensed merchant seamen 748
Ship's electricians, *see:* Unlicensed merchant seamen 749
Shirt finishers, laundry and drycleaning 835
Shoe repairmen 563
Shooters, petroleum and natural gas 595
Shop trades, railroad 775
Shotblasterers, *see:*
  Forge shop 447
  Foundry industry 661
Shothole drillers, petroleum and natural gas 595
Shothole drillers, helpers, petroleum and natural gas 595
Showroom models 362
Signal department workers, railroad 777
Signal maintainers, railroad 777
Signalmen, railroad 777
Silk screen printers, electronics manufacturing 655
Singers and singing teachers 189
Skilled and other manual occupations 365
Skilled workers 365
Skipmen, iron and steel 676
Slaggers, iron and steel 676
Slate roofers, building trades 417
Slicing-and-wrapping machine operators, baking 641
Slide mounters, *see:* Photographic laboratory occupations 559
Soaking pit cranemen, iron and steel 678

Page
Soaking pit operators, aluminum 616
Social caseworkers 267
Social psychologists 262
Social scientists 199
Social secretaries 300
Social service aides 360
Social workers 266
Sociologists 209
Sociologists, rural, *see:* Agriculture 590
Soil conservationists 588
Soil scientists 587
Sorters, *see:* Bank clerks 806
Sorters, *see:* Paper and allied products industries 702
Sorting machine operators 293
Sound effects technicians, radio and television 754
Spacecraft manufacturing occupations 605
Special agents, *see:* FBI Special Agents 345
Special librarians 250
Specialty farm operators 582
Specifications writers, *see:* Electronics manufacturing 653
Speech pathologists 120
Spot welders, electronics manufacturing 655
Spotters, laundry and drycleaning 836
Sprayers, motor vehicle and equipment manufacturing 689
Spreaders, apparel industry 623
Sprinkler fitters, *see:* Plumbers and pipefitters . 413
Staff adjusters, claim adjusters 817
Staff officers, *see:* Licensed merchant marine officers 745
Stage managers, radio and television 754
State and local government occupations 847
State extension workers 586
State highway patrolmen 349
State police officers 349
Station agents, civil aviation 728
Station agents, railroad 773
Station installers, telephone 789
Stationary engineers 565
    See also:
        Aluminum industry 618
        Baking industry 643
        Paper and allied products 702
Stationary firemen (boiler) 567
Statisticians 142
    See also:
        Electronics manufacturing 652
        Office machine and computer manufacturing 695
Steamfitters, *see:* Plumbers and pipefitters 413
Steel industry occupations 674
Steel pourers, iron and steel 677
Stenographers and secretaries 299
Stereotypers, printing (graphic arts) 522
Stewardesses, civil aviation 720
Stillmen, petroleum refining 708
Stock chasers, motor vehicle and equipment manufacturing 690
Stock clerks 298
Stock clerks, motor vehicle and equipment manufacturing 690
Stock house larrymen, iron and steel 676
Stock house men, iron and steel 676
Stonehands, printing (graphic arts) 517
Stonemasons 421
Stove tenders, iron and steel 676
Stratigraphers, *see:* Geologists 149
    See also: Petroleum and natural gas production and processing 595
Stretcher-leveler-operators, aluminum industry 617
Strippers, printing (graphic arts) 525
Structural-iron workers, building trades 423
Structural-, ornamental-, and reinforcing-iron workers, riggers, and machine movers 423
Studio supervisors, radio and television 754
Stylists, motor vehicle and equipment manufacturing 686
Substation operators, electric power 736
Supercalendar operators, paper and allied products 702
Surfacers, optical mechanics 540
Surgical technicians 97
Surveyors 269
    See also: Petroleum and natural gas production and processing 595
Switchboard operators, electric power 733
Switchboard operators, telephone 304
Switchers, petroleum and natural gas 597
Switchmen, railroad 771
Switchmen, telephone 784
Synoptic meteorologists 154
Systems analysts 257
    See also:
        Insurance 813
        Office machine and computer manufacturing 695
        Paper and allied products industry .. 703

Page

Tablet coaters, drug industry 648
Tablet testers, drug industry 648
Tabulating machine operators 293
Tailoring occupations, apparel 625
Tailors, apparel 625
Tape librarians, *see:* Electronic computer operating personnel 289
Tape perforating machine operators, printing (graphic arts) 519
Tape perforator typists, *see:* Typists 303
Tape-to-card converter operators, *see:* Electronic computer operating personnel 289
Tappers, *see:* Aluminum industry 615
Taxi drivers 442
Teachers, college and university 216
Teachers, dancing 184
Teachers, drama 182
Teachers, high school 214
Teachers, home economists 241
Teachers, kindergarten and elementary school . 211
Teachers, music 186
Teachers, secondary school 214
  See also: Home economists 241
Teachers, singing 189
Teaching 211
Technical illustrators, *see:*
  Aircraft, missile, and spacecraft manufacturing 607
  Electronics manufacturing 653
Technical stenographers 300
Technical writers 233
  See also:
    Aircraft, missile, and spacecraft manufacturing 607
    Electronics manufacturing 653
Technician occupations 220
Technicians, broadcasting, radio and television 759
Technicians, dental laboratory 89
Technicians, drug industry 647
Technicians, engineering and science 220
  See also:
    Petroleum refining 708
    Paper and allied products industry .. 703
Technicians, forestry, *see:* Forestry aids 50
Technicians, medical X-ray 126
Technicians, optical laboratory 539
Technicians, sound effects, radio and television 754
Technicians, surgical 97

Page

Technicians, television and radio service 502
Tectonophysicists, *see:* Geophysicists 152
Telegraphers, telephoners, and towermen, railroad 772
Telephone and PBX installers and repairmen 789
Telephone central office equipment installers .. 786
Telephone craftsmen 784
Telephone industry occupations 781
Telephone installers 789
Telephone installers-repairmen 790
Telephone linemen and cable splicers 787
Telephone operators 303
Telephone repairmen 790
Telephone servicemen 789
Telephoners, railroad 772
Teletypists, civil aviation 727
Television announcers 758
Television broadcasting occupations 752
Television and radio service technicians 502
Tellers, banking 808
Tellers, cashier 286
Terrazzo workers, building trades 401
Test-set operators, *see:* Office machine and computer manufacturing 696
Testers, electronics manufacturing 655
Testing machine operators, office machine and computer manufacturing 696
Testboardmen, telephone 784
Theoretical physicists 173
Therapeutic dietitians 130
Therapists, inhalation 102
Therapists, occupational 113
Therapists, occupational assistants 115
Therapists, physical 116
Thermal cutters, *see:* Welders 572
Third assistant engineers, *see:* Licensed merchant marine officers 745
Third mates, *see:* Licensed merchant marine officers 744
Ticket agents, civil aviation 728
Ticket sellers, *see:* Cashiers 286
Tile roofers, building trades 416
Tile setters, building trades 401
Time salesmen, radio and television 755
Tinners, electronics manufacturing 655
Tobacco farmers 584
Tool-and-die makers 456
  See also:
    Aircraft, missile, and spacecraft manufacturing 608

Page

  - Electronics manufacturing 655
  - Iron and steel industry 680
  - Motor vehicle and equipment manufacturing 688
  - Office machine and computer manufacturing 696
- Tool designers, *see:* Mechanical technicans 223
- Tool pushers, petroleum and natural gas 596
- Toolmakers, electronics manufacturing 655
- Topographic surveyors 270
- Towermen, railroad 773
- Toxicologists, drug industry 646
- Tracers, *see:* Draftsmen 226
- Track workers, railroad 778
- Trackmen, railroad 778
- Traffic agents and clerks, civil aviation 728
- Traffic controllers, air-route 725
- Traffic controllers, airport 725
- Traffic managers, industrial 279
- Traffic managers, radio and television 754
- Traffic representatives, civil aviation 728
- Train directors, railroad 773
- Trainmen, *see:* Brakemen, railroad 771
- Transcribing machine operators, *see:* Typists 303
- Transit clerks, *see:* Bank clerks 807
- Transmission and distribution occupations, electric power 736
- Transmitter technicians, radio and television 760
- Transportation, communication, and public utilities 711
- Treaters, *see:*
  - Petroleum and natural gas 597
  - Petroleum refining 708
- Treatment plant operators, wastewater 569
- Trimmers, hand, apparel 625
- Trimmers, forge shop 447
- Trimmers, automobile (automobile upholsterers) 532
- Trimmers, motor vehicle and equipment manufacturing 690
- Troopers, *see:* State police officers 349
- Troublemen, electric power 737
- Truck mechanics 505
  - *See also:* Trucking industry 793
- Truckdriver's helpers 793
- Truckdrivers, *see:*
  - Baking industry 642
  - Drug industry 648
  - Office machine and computer manufacturing 697
  - Trucking industry 793
- Truckdrivers, local 431
- Truckdrivers, over-the-road 427
- Trucking industry 792
- Trust investment clerks, *see:* Bank clerks 807
- Trust officers, banking 810
- Tube benders, aircraft, missile, and spacecraft 609
- Tumbler operators, foundry industry 661
- Tune-up men, *see:* Automobile mechanics 472
- Turbine operators, electric power 733
- Type inspectors, office machine and computer manufacturing 697
- Typesetters, hand, printing (graphic arts) 517
- Typesetting machine operators, printing (graphic arts) 517
- Typewriter servicemen 478
- Typists 302

- Understudies, *see:* Actors and actresses 181
- Underwriters, insurance 821
  - *See also:* Insurance 813
- United States Government occupations 839
- University librarians 250
- Unlicensed merchant seamen 748
- University teachers 216
- Unskilled workers, laborers 369
- Upholsterers, *see:*
  - Automobile trimmers and installation men 532
  - Furniture upholsterers 544
- Upsetters, forge shop 446
- Urban geographers 203
- Urban planners 272
- Utilitymen, *see:* Unlicensed merchant seamen 749

- Valets, *see:* Private household workers 357
- Vending machine mechanics 507
- Vending machine routemen, *see:* Routemen 434
- Veterinarians 136
  - *See also:* Agriculture 589
- Video-control technicians, television 760
- Video-tape recording technicians, television 760
- Virologists, *see:* Drug industry 646
- Vocational agriculture teachers, *see:* Agriculture 590
- Vocational counselors, *see:* Employment counselors 55
- Vocational nurses 94
- Volcanologists, *see:* Geologists 149

- Waiters and waitresses 339
- Washers, *see:* Trucking industry 793

Page
Washmen, laundry and drycleaners 835
Waste disposal men, atomic energy 636
Waste-treatment operators, atomic energy 636
Waste treatment engineers and technicians, *see:*
  Petroleum refining 709
Wastewater treatment plant operators 569
Watch engineers, electric power 734
Watch repairmen 510
Watchmakers 510
Watchmen 343
Waterproof workers, *see:* Roofers 417
Waybill clerks, *see:* Typists 303
Weather forecasters, *see:* Meteorologists 154
Welders, petroleum and natural gas 597
Welders and oxygen cutters 571
  See also:
    Aluminum industry 618
    Aircraft, missile, and spacecraft manufacturing 609
    Iron and Steel industry 681
    Motor vehicle and equipment manufacturing 689
    Natural gas processing 597

Page
Welders, gas 572
Welding operators, resistance 572
Well pullers, petroleum and natural gas 597
Wheat farmers 584
Wholesale and retail trade 797
Wholesale models 362
Wholesale trade salesworkers 327
Wipers, *see:* Unlicensed merchant seamen 748
Wire chiefs, railroad 773
Wire draw operators, aluminum 617
Wire drawers, iron and steel 680
Wood patternmakers, foundry industry 663
Writers, technical 233
  See also listing under Technical writers.
Writing occupations 231

X-ray technicians, medical 126

Yard foremen, railroad 770

Zoologists, *see:*
  Drug industry 646
  Life scientists 162

OCCUPATIONAL OUTLOOK REPRINT SERIES

Bulletin No.		*Price (cents)*
1	Tomorrow's Jobs	15
	PROFESSIONAL, MANAGERIAL, AND RELATED OCCUPATIONS	
	Business Administration and Related Professions	
2	Accountants	10
3	Advertising Workers, Marketing Research Workers, Public Relations Workers	15
4	Personnel Workers	10
5	Industrial Traffic Managers, Purchasing Agents	10
	Health Service Occupations	
6	Physicians, Osteopathic Physicians	10
7	Dentists	10
8	Dental Hygienists, Dental Assistants, Dental Laboratory Technicians	15
9	Registered Nurses, Licensed Practical Nurses, Hospital Attendants	15
10	Optometrists, Optometric Assistants	10
11	Pharmacists	10
12	Podiatrists	10
13	Chiropractors	10
14	Occupational Therapists, Occupational Therapy Assistants, Physical Therapists, Physical Therapy Assistants	15
15	Speech Pathologists and Audiologists	10
16	Medical Assistants, Surgical Technicians, EEG Technicians, EKG Technicians, Inhalation Therapists	15
17	Medical Laboratory Workers	10
18	Radiologic Technologists	10
19	Medical Record Librarians	10
20	Dietitians	10
21	Hospital Administrators	10
22	Sanitarians	10
23	Veterinarians	10
	Scientific and Technical Occupations	
24	Engineers Aerospace, Agricultural, Biomedical, Ceramic, Chemical, Civil, Electrical, Industrial, Mechanical, Metallurgical, Mining	20
25	Environmental Scientists Geologists, Geophysicists, Meteorologists, Oceanographers	20
26	Life Science Occupations Life Scientists, Biochemists	15
27	Physical Scientists Chemists, Physicists, Astronomers, Food Scientists	15
28	Technicians Engineering and Science, Draftsmen, Food Processing	15
	Other Professional and Related Occupations	
29	Architects	10
30	City Managers	10
31	Clergymen Protestant Clergymen, Rabbis, Roman Catholic Priests	15
32	Commercial Artists, Industrial Designers, Interior Designers and Decorators	15
33	Conservation Occupations Foresters, Forestry Aids, Range Managers	15
34	Counseling and Placement Occupations School Counselors, Rehabilitation Counselors, Employment Counselors, College Career Planning and Placement Counselors	15
35	Home Economists	10
36	Landscape Architects	10
37	Lawyers	10
38	Librarians, Library Technicians	15
39	Mathematics and Related Fields Mathematicians, Statisticians, Actuaries	15
40	Performing Arts Occupations Actors and Actresses, Dancers, Musicians and Music Teachers, Singers and Singing Teachers	15
41	Photographers, Photographic Laboratory Occupations	15
42	Programers, Systems Analysts, Electronic Computer Operating Personnel	15
43	Psychologists	10
44	Recreation Workers	10
45	Social Sciences Anthropologists, Economists,	

Bulletin No.		Price (cents)
	Social Sciences—(Cont'd)	
	Geographers, Historians, Political Scientists, Sociologists	15
46	Social Workers, Social Service Aides	15
47	Surveyors	10
48	Teachers	
	Kindergarten and Elementary School Teachers, Secondary School Teachers, College and University Teachers	15
49	Urban Planners	10
50	Writing Occupations	
	Newspaper Reporters, Technical Writers	15
	CLERICAL AND RELATED OCCUPATIONS	
51	Bookkeeping Workers, Office Machine Operators	10
52	Cashiers	10
53	File Clerks	10
54	Receptionists	10
55	Shipping and Receiving Clerks	10
56	Stenographers and Secretaries, Typists	10
57	Stock Clerks	10
58	Telephone Operators	10
	SALES OCCUPATIONS	
59	Automobile Salesmen	10
60	Insurance Agents and Brokers	10
61	Retail Trade Salesworkers, Wholesale Trade Salesworkers, Manufacturers' Salesmen	15
62	Real Estate Salesmen and Brokers	10
63	Securities Salesmen	10
	SERVICE OCCUPATIONS	
64	Barbers, Cosmetologists	10
65	Building Custodians	10
66	Cooks and Chefs, Waiters and Waitresses, Bartenders	15
67	FBI Special Agents	10
68	Firefighters	10
69	Guards and Watchmen	10
70	Models	10
71	Police Officers, State Police Officers	15
72	Private Household Workers	10
	SKILLED AND OTHER MANUAL OCCUPATIONS	
	Building Trades	
73	Asbestos and Insulating Workers	10

Bulletin No.		Price (cents)
74	Bricklayers, Stonemasons, Marble Setters, Tile Setters, Terrazzo Workers	10
75	Carpenters, Painters and Paperhangers, Glaziers	15
76	Cement Masons, Lathers, Plasterers	15
77	Construction Laborers and Hod Carriers	10
78	Electricians (Construction)	10
79	Elevator Constructors, Structural-, Ornamental-, and Reinforcing-Iron Workers, Riggers, Machine Movers	10
80	Floor Covering Installers	10
81	Operating Engineers (Construction)	10
82	Plumbers and Pipefitters	10
83	Roofers, Sheet-Metal Workers	10
	Mechanics and Repairmen	
84	Automobile Service Occupations	
	Automobile Body Repairmen, Automobile Mechanics, Truck and Bus Mechanics, Automobile Trimmers and Installation Men (Automobile Upholsterers), Automobile Parts Countermen, Automobile Service Advisors, Gasoline Service Station Attendants	20
85	Air-Conditioning, Refrigeration, and Heating Mechanics	10
86	Appliance Servicemen	10
87	Bowling-Pin-Machine Mechanics	10
88	Business Machine Servicemen	15
89	Diesel Mechanics, Farm Equipment Mechanics	10
90	Electric Sign Servicemen	10
91	Maintenance Electricians, Industrial Machinery Repairmen, Millwrights	15
92	Motorcycle Mechanics	10
93	Instrument Repairmen	10
94	Jewelers and Jewelry Repairmen, Watch Repairmen	15
95	Television and Radio Service Technicians	10
96	Vending Machine Mechanics	10
	Other Manual Occupations	
97	Blacksmiths	10
98	Boilermaking Occupations	10
99	Dispensing Opticians, Optical Mechanics	10
100	Driving Occupations	
	Over-the-road Truckdrivers, Local Truckdrivers, Routemen, Intercity Busdrivers,	

Other Manual Occupations—(Cont'd)

Bulletin No.		*Price (cents)*
	Local Transit Busdrivers, Taxi Drivers	20
101	Factory Operatives Assemblers, Electroplaters, Inspectors, Power Truck Operators, Production Painters	15
102	Forge Shop Occupations	10
103	Foremen	10
104	Furniture Upholsterers	10
105	Machining Occupations All-round Machinists, Machine Tool Operators, Tool and Die Makers, Instrument Makers (Mechanical), Setup Men (Machine Tools)	15
106	Meat Cutters	10
107	Motion Picture Projectionists	10
108	Parking Attendants	10
109	Printing Occupations Composing Room Occupations, Photoengravers, Electrotypers Photoengravers, Electrotypers and Stereotypers, Printing Pressmen and Assistants, Lithographic Occupations, Bookbinders and Related Workers	20
110	Shoe Repairmen	10
111	Stationary Engineers, Stationary Firemen (Boiler)	10
112	Waste Water Treatment Plant Operators	10
113	Welders, Oxygen and Arc Cutters	10

SOME MAJOR INDUSTRIES AND THEIR OCCUPATIONS

Bulletin No.		*Price (cents)*
114	Agriculture Cooperative Extension Service Workers, Soil Scientists, Soil Conservationists, Other Professional Workers, Farm Service Jobs	15
115	Petroleum and Natural Gas Production and Processing, Petroleum Refining	15
116	Aircraft, Missile, and Spacecraft Manufacturing	15
117	Aluminum Industry	15
118	Apparel Industry	15
119	Atomic Energy Field	15
120	Baking Industry	10
121	Drug Industry	15
122	Electronics Manufacturing	15
123	Foundries Patternmakers, Molders, Coremakers	15
124	Industrial Chemical Industry	10
125	Iron and Steel Industry	15
126	Motor Vehicle and Equipment Manufacturing	15
127	Office Machine and Computer Manufacturing	15
128	Paper and Allied Products Industries	15
129	Civil Aviation Pilots and Copilots, Flight Engineers, Stewardesses, Aircraft Mechanics, Airline Dispatchers, Air Traffic Controllers, Ground Radio Operators and Teletypists, Traffic Agents and Clerks	20
130	Electric Power Industry Powerplant Occupations, Transmission and Distribution Occupations, Customer Service Occupations	15
131	Merchant Marine Occupations Licensed Merchant Marine Officers, Unlicensed Merchant Seamen	15
132	Radio and Television Broadcasting Radio and Television Announcers, Broadcast Technicians	15
133	Railroads Locomotive Engineers, Locomotive Firemen (Helpers), Conductors, Brakemen, Telegraphers, Telephoners, Towermen, Station Agents, Clerks, Shop Trades, Signal Department Workers, Track Workers, Bridge and Building Workers	20
134	Telephone Industry Central Office Craftsmen, Central Office Equipment Installers, Linemen and Cable Splicers, Telephone and PBX Installers and Repairmen	15
135	Trucking Industry	10
136	Restaurants	10
137	Banking Bank Clerks, Tellers, Bank Officers	15
138	Insurance Claim Adjusters, Claim Examiners, Underwriters	15
139	Hotels Bellmen and Bell Captains, Front Office Clerks, Housekeepers and Assistants, Managers and Assistants	15
140	Laundry and Drycleaning Plants	10
141	Government (Except Post Office) Federal Civilian Employment, State and Local Governments, Armed Forces	15

☆ U.S. GOVERNMENT PRINTING OFFICE: 1972 O—427-455

Visual Aid for Vocational Counselors . . .

JOBS FOR THE 1970'S

A set of color slides describing the occupational composition of today's work force and the changes anticipated during the 1970's. The series graphically shows:

- **—Current employment by occupation and industry,**
- **—The kinds of jobs which will open during the 1970's,**
- **—Fields of work which are especially promising,**
- **—The impact of technology on manpower needs,**
- **—The changing characteristics of the work force.**

JOBS FOR THE '70'S updates an earlier Bureau of Labor Statistics slide series, Looking Ahead to a Career. The series has been revised completely to reflect 1970 employment data and occupational projections through 1980.

JOBS FOR THE '70'S consists of 40 slides (35 mm, 2x2 inches) and accompanying narrative booklet. Price: $10 a set.

- -

JOBS FOR THE 1970'S

ORDER FORM

NAME______________________________
STREET ADDRESS______________________________
CITY, STATE____________________ZIP CODE__________

NUMBER OF slide sets_____at $10 each. TOTAL AMOUNT ______

Make check or money order payable to the BUREAU OF LABOR STATISTICS. Enclose with order blank and mail to the Bureau of Labor Statistics Regional Office nearest you:

1603-A Federal Bldg.
Boston, Mass. 02203

1371 Peachtree St., NE.
Atlanta, Ga. 30309

1100 Commerce St., Rm. 6B7
Dallas, Texas 75202

341 Ninth Ave., Rm. 1025
New York, N.Y. 10001

219 S. Dearborn St.
Chicago, Ill. 60604

450 Golden Gate Ave.
San Francisco, Calif. 94102

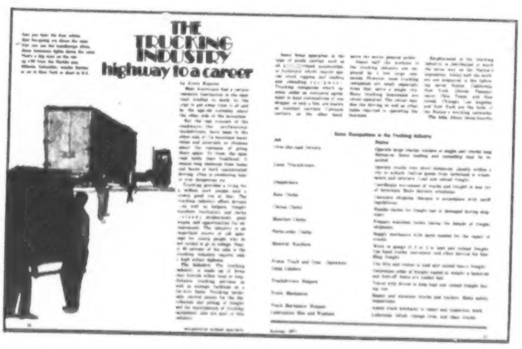
1317 Filbert St.
Philadelphia, Pa. 19107

911 Walnut St.
Kansas City, Mo. 64106

the Occupational Outlook Quarterly

Today's Magazine for Tomorrow's Jobs

Motorcycle Mechanics



THE TRUCKING INDUSTRY highway to a career

HOW INDUSTRY RECRUITS Ph.D.'s

Opport
in Sub
Health

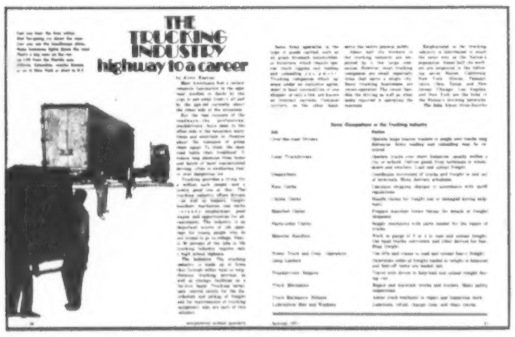
JOBS

That's what the *Occupational Outlook Quarterly* is all about. It's a how-to-do-it magazine covering new and emerging jobs, training and educational opportunities, salary trends, job prospects to 1980 . . . the facts young people need to plan careers with a future.

The *Quarterly* is "must" reading for counselors, educators, and other manpower specialists who want to keep abreast of occupational developments between biennial editions of the *Occupational Outlook Handbook*.

Look to the *Quarterly* for new perspectives on employment problems and changing technology, for bibliographies of inexpensive new Government publications on manpower and career opportunities, and for summaries of the latest Bureau of Labor Statistics studies of employment trends and occupational outlook.

To get all the facts about tomorrow's jobs, subscribe to the *Quarterly* today. It's published 4 times a year by the U.S. Department of Labor. Price: $3.00 for a 2-year subscription.



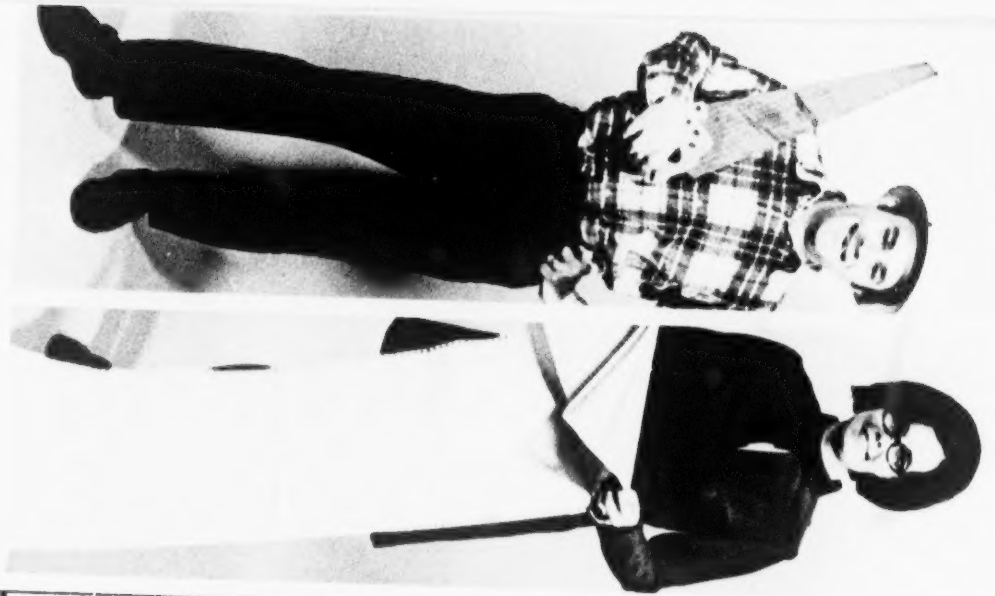
THE TRUCKING INDUSTRY highway to a career

A Three-in-One Job: Doctor, Wife, Mother. Can It Be?

THE DRAFT LOTTERY

And how it works

Opportunities in Subprofessional Health Occupations



PLEASE FILL IN BOTH THIS ORDER FORM AND THE ATTACHED MAILING LABEL

MAIL ORDER FORM TO:

Superintendent of Documents, Government Printing Office,
Washington, D.C. 20402

ENCLOSED FIND $__________(check, money order), **FOR THE OCCUPATIONAL OUTLOOK QUARTERLY**

☐ 2-YEAR subscription $3.00; ☐ FOREIGN $4.00 Total $________

Name

Street address

City, State, and ZIP Code

For Use of Supt. Docs.

_____Enclosed________

_____To be mailed later________

_____Subscription________

Refund________

Coupon refund________

Postage________

U.S. GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS
WASHINGTON, D.C. 20402

OFFICIAL BUSINESS
RETURN AFTER 5 DAYS

U.S.MAIL

FEES AND POSTAGE PAID
U.S. GOVERNMENT
PRINTING OFFICE

Name

Street address

City, State, and ZIP Code